DOES NOT APPLY TO CLASS I WELLS

ATTACHMENT H

OPERATING DATA

SUBSURFACE

H. OPERATING DATA

Estimated average and maximum injection rate and volume

The estimated maximum injection rate for the proposed wells will be 400 gal/min, and the estimated average injection rate will be 400 gal/min. The estimated total volume of injectate for the project is 4,207,680,000 gallons (400 gal/min x 1,440 min/day x 365.25 day/yr x 20 yr) which is based on an average injection rate of 400 gal/min and a project life of 20 years.

Estimated average and maximum injection pressures

Using the reservoir data presented in Attachment A, the estimated average injection pressure at an average injection rate of 400 gal/min is 330 psi, assuming a skin factor of 0. A pressure loss of 437 psi was calculated for an injection rate of 400 gpm, based on 5,880 feet of 4½ inch, 11.6 lb/ft carbon steel injection tubing.

The surface injection pressure calculations for the estimated average and maximum injection rates are based on the equation presented in Attachment A as shown below:

$$P_{(\text{surface @ 400 gpm})} = P_0 + \Delta P_{(\text{rise @ 400 gpm})} + P_{(\text{friction @ 400 gpm})} + \Delta P_{(\text{skin @ 400 gpm})} - P_h$$

$$= 1{,}283 + 1{,}194 + 437 + 0 - (0.4395)(5{,}880)$$

$$= 330 \text{ psi}$$

Skin factor is an unknown variable and is dependent on the waste treatment process. This process is being designed to minimize the skin factor. The actual skin factor will be determined from an analysis of the pressure transient fall-off data that will be run after the well has been drilled and completed, and the treatment facility performance has been verified.

Source(s) of waste (brief description of industrial process(es) which produce the waste)

The injectate being disposed in the proposed deep well is the product of a flue gas de-sulfurization process (FGD) at a coal-fired electrical power plant. The flue gas is run through a scrubbing operation with effluent de-watered resulting in the production of gypsum. The gypsum is collected and, if economically feasible, marketed for use in building materials. The resulting fluid is then run through a water treatment facility to condition it in a manner that will make it acceptable for deep well injection.

The injectate pH will range from typically 6.5 to 7.5, with an average of 6.9. The specific gravity is expected to range from 1.00 to 1.02. The temperature of the injected fluid will be approximately 100° F and will depend mainly on processing requirements.

Representative Waste Analysis

PSI supplied a wastewater sample for analysis from a power generating plant that has in place a similar system to that which is proposed for Gibson Station. A copy of the analysis of this sample is included as Appendix A-1 in Attachment A and is also attached as an Appendix to the Waste Analysis Plan included in Attachment P, Monitoring Program.

Plans for corrosion monitoring, if the waste is corrosive

The wastewater injectate is a non-corrosive hard water with the principal ingredients of calcium and magnesium sulfate with minor traces of metals. Ferrous metals, according to Perry's Chemical Engineers Handbook, Volume Six, are compatible with this waste fluid. Consequently, no corrosion monitoring program has been proposed.

The well component materials at the PSI facility were selected using standard engineering specifications for specific functions with a balance sought between engineering serviceability and economics.

ATTACHMENT I

FORMATION TESTING PROGRAM

I. FORMATION TESTING PROGRAM

Procedures to verify depth of lowermost USDW, if needed

The USDW has been calculated previously to be at 400 feet bgs. The surface hole will be drilled to 500 feet (100 feet below the base of the USDW) and will allow the geophysical logs (Table L-2) to record the base of the USDW.

The resistivity of the formation water will be calculated using the resistivity and porosity values recorded on the logs.

There is no open-hole testing planned to sample the lowermost USDW during the installation of the first well.

Procedures to obtain extrapolated formation pressure in porous and permeable zones within approximately 500 feet of the top of the injection zone (non-hazardous wells) or injection interval (hazardous wells)

As discussed in Sections L and M, a series of drill stem tests will be conducted during the drilling of the well. The intervals to be tested will be determined from data collected while drilling. The open-hole drill stem tests will provide preliminary reservoir information regarding permeability-thickness product and bottomhole pressure.

The open-hole testing, combined with the open-hole geophysical log interpretations, will determine the primary injection zone to be targeted during well completion. Casing will be set at the top of the selected injection zone and cemented as described in Sections L and M. Injection and pressure falloff testing will be conducted as detailed in steps 10 through 12 of the Completion Procedure discussed in Section L.

The original formation pressure obtained from the pressure falloff testing will be used to calculate the formation pressures in porous zones within 50 feet of the top of the injection zone. The specific gravity of the fluid will be measured from samples of the formation fluid recovered in steps 5 and 6 of the Completion Procedure discussed in Section L.

The following equation will be used to extrapolate pressure to a well depth within 500 feet from the top of the Injection Interval:

$$P_D = P_L - 0.433\gamma_f(L - D)$$

Where:

P_D = Extrapolated formation pressure at depth D feet BGL, psia

P_L = Formation pressure measured at depth L feet BGL, psia

γ_f = Specific gravity of formation fluid sample recovered from Injection Interval

L = Depth BGL of pressure measurement taken in Injection Interval

Sampling and analysis procedures for formation fluid of 1) the first aquifer overlying the confining zone (hazardous and non-hazardous waste wells), 2) the injection zone (non-hazardous waste wells) or injection interval (hazardous waste wells), and 3) the containment interval (hazardous waste wells only).

When the primary injection interval is determined, the first aquifer overlying the confining zone will be sampled utilizing a wireline conveyed repeat formation tester while conducting the open-hole geophysical logging. A standard water analysis will be conducted to determine physical and chemical properties.

Cores and laboratory core testing for confining and injection zones (For non-hazardous waste wells, a minimum of one 30-foot core of the confining zone and one 30-foot core of the injection zone are required. For hazardous wells where injection of restricted waste is proposed, one or more cores of the containment interval will also be necessary.)

As previously discussed, the primary injection zone will be determined during drilling of the first well. Consequently, the confining and injection zones will be cored using rotary sidewall cores or percussion sidewall cores during the geophysical logging. Full-hole cores will be obtained in specific intervals during the drilling of subsequent wells.

Physical core analysis will include lithologic descriptions of all core recovered. Rock density, porosity, and air permeability will be determined on four whole core samples selected from each length of core sampled. In addition, permeability to both waste and brine will be determined for four plug samples taken from each length of core. Both horizontal and vertical permeability will be measured. Brine and waste permeability measurements will be run utilizing methods with a high range of accuracy (10^3 to 10^{-6} md).

Testing for mechanical rock properties will include determinations of Young's Modulus, Poisson's Ratio, Tensile Strength, and Bulk Compressibility. Four samples from each length of core will be tested. Injectate compatibility testing will be conducted with fluids and matrix material derived from the injection zone.

Compatibility testing of the injectate with the formation fluid will include analysis of two fluid samples from the injection interval and injectate fluid sample combined in increasingly larger ratios with injectate to determine reactivity. These samples will be filtered and weighed to determine solids generation as a function of time. In addition, compatibility of the injectate with two core samples from the injection zone will be tested. A core flow study will be preformed following various combinations of formation fluid mixed with injectate through the core for a designated period of time.

Determination of fracture closure pressure of injection zone (non-hazardous wells) or injection interval (hazardous wells)

Fracture closure pressure will be determined during the step-rate test of the injection zone discussed in step 10 of the Construction Procedure in Section L. This data will be collected in support of the geophysical calculations of the mechanical properties of the formation.

Injectivity/fall-off testing of injection zone/interval, including interference testing if multiple wells are proposed

An injection/falloff test is included in steps 10 and 11 of Section L. The testing will be performed in accordance with USEPA Region V Guidelines for Reservoir Testing (Regional Guidance #6). The rate and volume of fluid to be injected will be determined from preliminary injection testing results and will be based on the injectivity determined from those previous tests.

ATTACHMENT J

STIMULATION PROCEDURE

SUBSURFACE

J. STIMULATION PROCEDURE

It is not anticipated that the injection interval will need to be stimulated after drilling and completing the proposed PSI wells. However, if it is determined after drilling and testing the wells that the receptivity of the injection interval needs to be chemically enhanced to reduce formation skin damage, the injection interval may be treated with a mud acid (12% Hydrochloric and 3% Hydrofluoric Acid) program. This operation will consist of placing the mud acid across the entire injection interval and pumping the acid into the zone after the acid has been allowed to soak for an appropriate period. The exact volume, make-up and placement technique of the acid will be developed after the necessary performance data from the proposed injection wells have been collected and analyzed. The United States Environmental Protection Agency (USEPA) will be notified prior to any acid stimulation of the injection formation. It should be noted that during acid stimulations, the annulus pressure may not be maintained at a 100 psi differential over the injection pressure.

ATTACHMENT K

INJECTION PROCEDURES

K. INJECTION PROCEDURES

Plant plan showing flow line of waste stream(s) to be injected

A schematic diagram of the site plan showing the flow of the injectate to the proposed PSI injection wells has been included as Figure K-1.

Description of filters, storage tanks (including capacity), and any pretreatment processes and facilities, including location on plant plan.

Water received from the waste treatment facility will be injected into the wells with three, 200 gpm positive displacement injection pumps that are connected in parallel and have a maximum operating pressure of 700 psi. A sample tap will be located on the injectate flow line before the injection pumps.

Figure K-2 provides a simplified schematic diagram showing the flow of the injectate from the reactant prep and de-watering process, through the waste treatment facility to the injection well. The location of the surface facility equipment has also been illustrated on Figure K-1.

Description of injection pumps, including rate capacity

Three positive displacement injection pumps with a rate capacity of 200 gpm each and a maximum operating pressure of 700 psi will be used as the primary injection pumps. The three pumps will be manifolded in parallel as shown on Figure K-2.

Description of annulus pressure maintenance system

The annulus pressure maintenance system at each wellhead will consist of a 200 gallon, nitrogen pressurized pot that is filled with diesel oil and connected to the annulus of the 4½ inch injection tubing and 9⅝ inch protection casing. An annulus pot will have a sight glass to allow the diesel level to be monitored visually as well as an electronic transmission that will be monitored continuously at the main computer terminal.

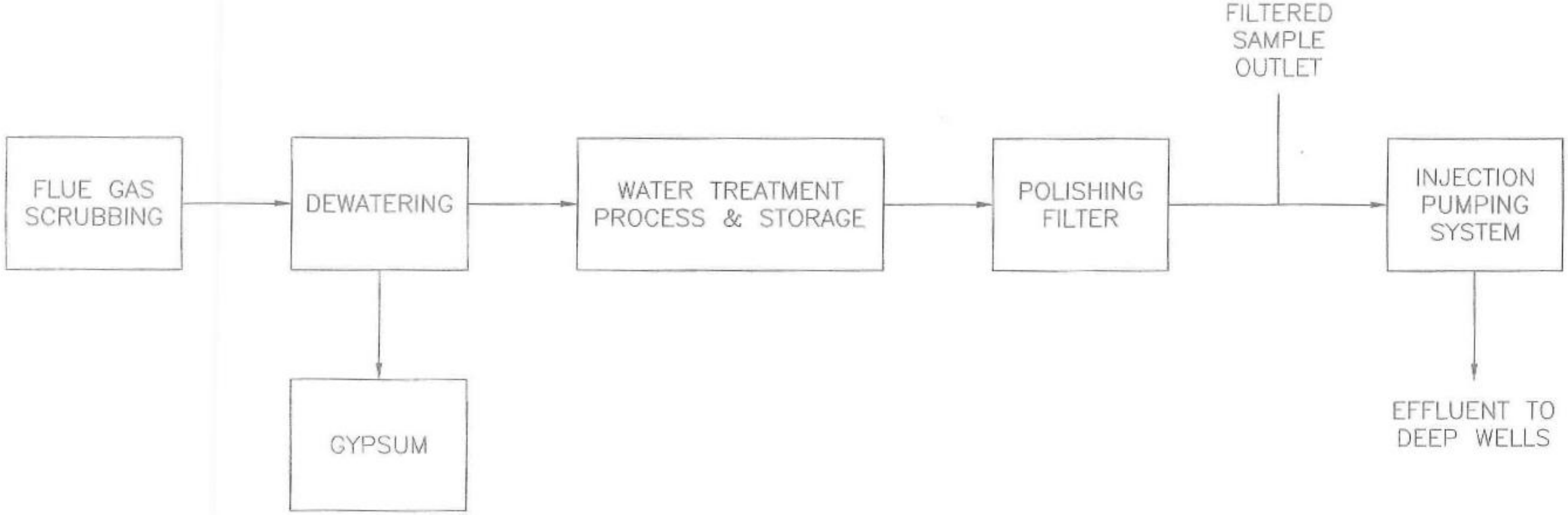
The annulus pressure will be maintained at least 100 psi above the wellhead injection pressure. An analog pressure gauge will be connected to the well annulus and a pressure transducer will also be connected to the well annulus that transmits a signal to a digital converter. The digital output of the annulus pressure will be transmitted to a computer for continuous monitoring of the annulus pressure.

A female coupling will be connected below the analog annulus pressure gauge to allow for independent determination of annulus pressure. A schematic diagram of the well annulus maintenance system has been included as Figure K-3.

Description of alarm and shut-off system

Continuous measurements of injection pressure and annulus pressure will be monitored by a shut-down system that will shut-down the injection pumps if the wellhead injection pressure exceeds a predetermined maximum allowable injection pressure or if the annulus pressure drops below a predetermined minimum allowable annulus pressure. The injection and annulus pressures will be monitored continuously with analog gauges on the wells and with transducers tied in with the main computer terminal.

FIGURES



SUBSURFACE

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

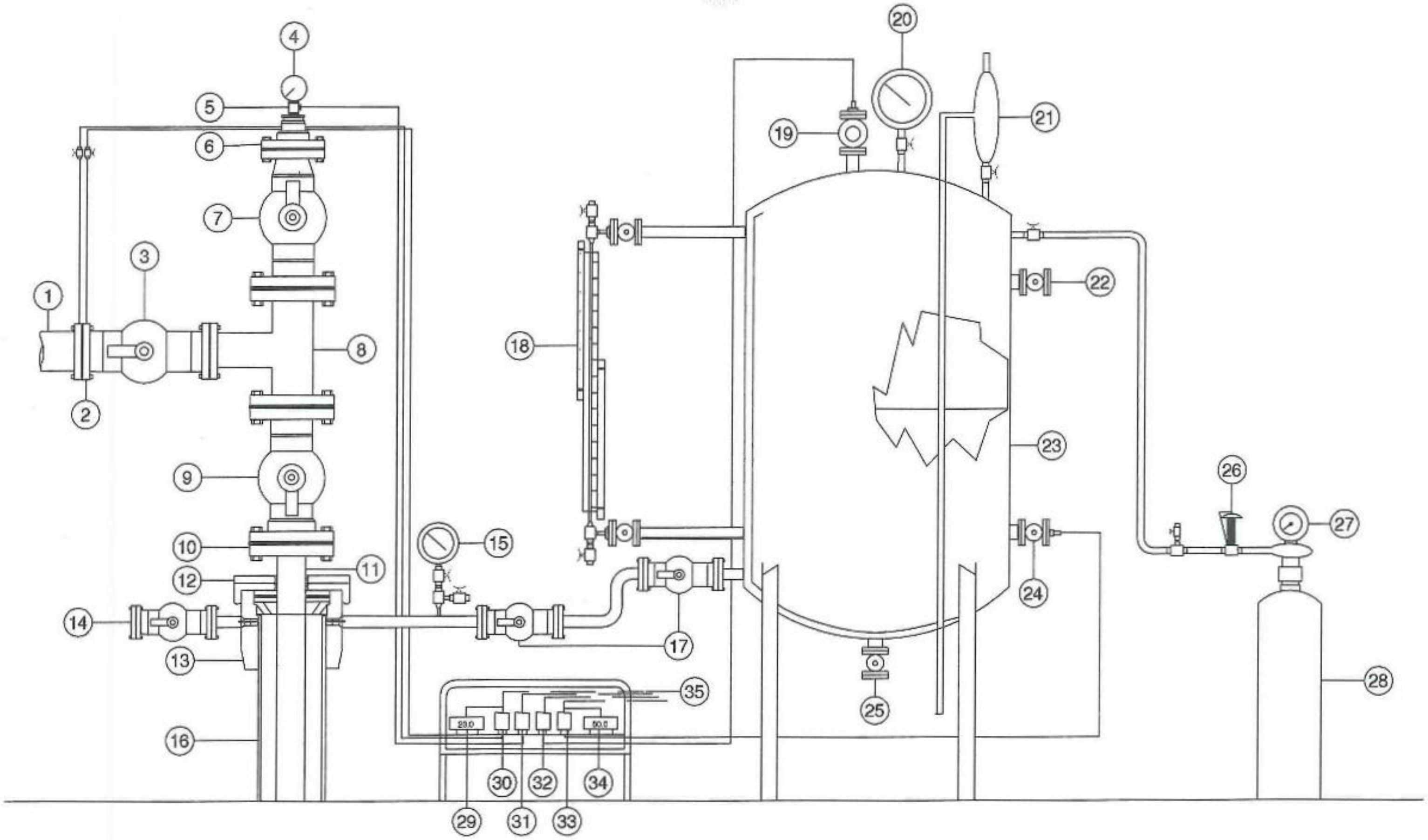
FIGURE K–2

PSI ENERGY, INC.

GIBSON GENERATING STATION

BLOCK FLOW DIAGRAM

DATE: 1/27/05	CHECKED BY: RJS	JOB NO: 60D5675
DRAWN BY: CRB	APPROVED BY: RTB	DWG. NO:



WELLHEAD DETAILS

1. Injection flow line, 6" o.d., from injection pumps
2. Injection flow rate sensing element (orifice plate and transmitter lines)
3. Injection wing valve, 6", full opening, 2,000 psi
4. Wellhead injection pressure gauge (0–3,000 psi scale)
5. wellhead injection pressure measuring point
6. Adapter flange, 4" by 6", 2,000 psi, with 2⅞", 8RD female connection inside flange
7. Swab valve, 6", full opening, 2,000 psi
8. Tee, 6", 2,000 psi
9. Master valve, 6", full opening, 2,000 psi
10. Companion flange, 6", 2,000 psi, with 4½" 8RD threads, LT&C
11. Injection tubing, 4½", 11.6 lb/ft, L-80, LT&C
12. Bonnet, 11" x 4½", 2,000 psi
13. Casinghead, 9⅝", SOW by 11", 2,000 psi with 4½" slip and seal assembly with two 2" line pipe outlets
14. Annulus block valve, 2" line pipe, 2,000 psi, with blind flange
15. Pressure gauge (0–3,000 psi scale) with female coupling connected below gauge for obtaining independent measurement of annulus pressure
16. Protection casing, 9⅝", 36 lb/ft, J-55, ST&C
17. Annulus block valves, 2" line pipe, 2,000 psi
18. Annulus pressure pot sight glass
19. Annulus pressure pot pressure measuring point
20. Annulus pressure pot pressure gauge
21. Annulus pressure pot safety valve
22. Annulus pressure pot fill valve
23. Annulus pressure pot, 200 gallons, 2,000 psi, filled with diesel oil
24. Annulus pressure pot tank level measuring point
25. Annulus pressure pot drain valve
26. Nitrogen pressure control valve
27. Nitrogen supply tank pressure gauge
28. Nitrogen supply tank
29. Local digital readout of injection flow rate
30. Injection flow transmitter
31. Injection wellhead pressure transmitter
32. Annulus pressure pot pressure transmitter
33. Annulus pressure pot level transmitter
34. Local digital readout of annulus pressure pot level
35. Transmitter signals to computer

SUBSURFACE

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

FIGURE K–3

PSI ENERGY, INC.

GIBSON GENERATING STATION

WELLHEAD DETAILS AND ANNULUS PRESSURE MAINTENANCE SYSTEM

DATE: 1/27/05	CHECKED BY: RJS	JOB NO: 60D5675
DRAWN BY: CRB	APPROVED BY: RTB	DWG. NO:

ATTACHMENT L

CONSTRUCTION PROCEDURES

SUBSURFACE

L. CONSTRUCTION PROCEDURES

Detailed Well Construction Procedures

There is very little specific information available to define the potential injection intervals at this specific location. It is anticipated that one, or more, intervals below the top of the Trenton formation may have the capacity to accept the required volume of injected waste. The first well will be drilled such that potential injection zones can be evaluated individually, by open-hole testing, to determine the injection potential. The first well will be completed in the deepest interval that appears to have the capacity. The subsequent wells may be completed in alternative intervals.

These construction procedures are developed to drill and test the individual zones to maximize the potential for injection completion. Intermediate casing will be set below the lowermost formation that is productive of hydrocarbons in the immediate area. The injection long-string casing or injection liner will be set above the selected injection interval and cemented to surface or to the top of the liner.

Drilling

1. Clear and level the location to accommodate rotary drilling equipment. Construct a lined reserve pit to contain the water-based drilling fluid and cuttings. It is not anticipated that salt-based drilling fluid will be required, therefore the cuttings will be land-farmed on the property owned by PSI after confirmation that the salt content is 3000 ppm or less.

2. Set conductor casing by either driving 20-inch, 0.40-inch minimum wall thickness, conductor casing to 75 feet below ground level, or auguring a 26-inch hole to 75 feet and setting the conductor casing with cement grout to surface.

3. Move in and rig up a rotary drilling rig and equipment capable of a total depth of 13,000 feet. Install a riser pipe on the conductor casing to contain drilling fluid while drilling the surface hole.

4. Mix a fresh water gel drilling fluid to drill the surface hole. Drill a 17-1/2 inch hole to 500 feet below ground level. Run deviation surveys at the base of the

conductor casing and on 60-foot intervals to 500 feet. The maximum allowable deviation of the surface hole will be 1 degree from vertical at 500 feet.

5. Run geophysical logs on the surface hole to identify the base of the USDW (Table L-2)

6. Run 13-3/8 inch surface casing as specified in Table M-2 to the total depth of the surface hole. Cement the surface casing to ground surface as detailed in Table M-1. Should the cement fail to circulate to surface or fall back below ground level, run 1-inch pipe to the top of the cement and fill the annulus to the surface with standard cement.

7. Run a temperature survey between 8 and 12 hours after the cement is in place to locate the top of the cement if it does not circulate to surface. Allow 24 hours for the cement to set before releasing the casing from the slips or elevators.

8. Cut the surface casing off at ground level and install a 13-5/8 inch, 3000-psi working pressure, weld-on casing head. Pressure test the surface casing to 1000 psig according to EPA Region V guidelines.

9. Run a 12-1/4 inch bit and drill the cement out of the shoe joint to the base of the surface casing. Run an 8-3/4 inch bit and a 12-1/4 inch stabilizer and drill five to 10 feet to center the 8-3/4 inch hole on bottom of the new hole.

10. Rig up a 24-hour, manned, mud logging unit to collect and evaluate samples, plot drilling time, and detect hydrocarbon shows while drilling.

11. Run an 8-3/4 inch bit and stabilized drilling assembly. Drill an 8-3/4 inch pilot hole to the base of the hydrocarbon bearing zones. Conduct deviation surveys on 90-foot intervals with a maximum deviation change of 1 degree per 100 feet and a total deviation not to exceed 5 degrees from vertical at any point in the well. Maintain good quality drilling fluid and solids separation equipment to minimize the weight of the drilling fluid and minimize hole erosion and washout.

12. Drill to the top of the Trenton formation (approximately 5000 feet) as determined by sample analysis and on-site evaluation. Drill an additional 100 feet of hole to allow the Trenton formation top to be recorded on the geophysical logs.

13. Run geophysical logs as detailed in Table L-2.

14. Determine the setting depth of the intermediate casing based on cutting sample analysis, open-hole log analysis, the top of any potential injection interval, and concurrence of EPA Region V. If hole conditions are suitable, considering borehole stability, excess washout, or lost circulation zones, continue drilling the pilot hole to total depth. Evaluate potential injection intervals below the top of the Trenton using data from cuttings analysis, drilling time, and open-hole drill stem tests. Conduct intermediate geophysical logs as needed to evaluate formation tops and potential injection intervals.

15. Once the depth of the intermediate casing is determined and geophysical logs have been run, obtain rotary or percussion sidewall cores of selected intervals for analysis. Run a cement bond log on the 13-3/8 inch surface casing.

16. Open the 8-3/4 inch hole to 12-1/4 inches to the casing setting depth. Run a 4-arm caliper survey to determine the measured casing/annulus volume.

17. Run 9-5/8 inch casing, according to the detail in Table M-2, to the desired depth. Cement the casing annulus to the surface, in one or two stages, as detailed in Table M-1.

18. Run a temperature survey between 8 and 12 hours after the cement is in place to locate the top of the cement if it does not circulate to surface. Run 1-inch pipe and fill the annulus to surface if necessary.

19. After 24 hours, release the 9-5/8 inch casing. Cut the 13-3/8 inch casing head off of the surface casing and remove it. Make a final cut on the 9-5/8 inch casing and install a weld-on 9-5/8 inch by 11-inch, 3000-psi casing head.

20. Install blowout preventers and drilling nipple. Run an 8-3/4 inch (or 8-1/2 inch) drilling assembly. Pressure test the casing above the stage collar (if present) to 1500 psi according to EPA guidelines. Drill out the stage collar and pressure test the casing and the stage collar. Clean out the casing to the shoe joint.

21. Run a cement bond log along the full length of the intermediate casing. Conduct the final intermediate casing pressure test according to EPA guidelines to certify mechanical integrity.

22. Drill out the cement from the shoe joint and clean out the open hole below the casing.

23. If the well has been drilled and logged to the final total depth prior to setting the intermediate casing, proceed with the completion of the open hole injection interval.

24. If the casing was set prior to reaching the final total depth of the well, continue drilling, evaluating, and testing the potential injection intervals that were not previously drilled following the drilling procedure described previously.

25. Determine, as previously described, the top of the shallowest potential injection interval below the intermediate casing.

26. Conduct geophysical logs on any new open-hole interval and run a 4-arm caliper to determine the annular volume for cementing.

27. Run a 7-inch liner from the top of the chosen injection interval and overlap the liner at least 200 feet into the bottom of the 9-5/8 inch casing. Cement the liner according to the details in Table M-1. As an alternate to the liner, run the 7-inch casing to the surface and cement the casing to the surface. The decision to run a liner or a long-string will be made, based on the geometry of the well, the depth of the intermediate casing, the length of the liner or long string and the concurrence of EPA Region V.

28. After the cement has cured for 24 hours, clean out the casing or liner to the shoe joint.

29. Run a cement bond log on the casing or liner as defined in Table M-1.

30. Pressure-test the liner (or casing) according to EPA guidelines for mechanical integrity.

31. The well will be completed as described in the continuation of this section.

Completion

1. Move out the rotary drilling equipment and prepare the location for a well completion rig. Move in a completion rig and ancillary equipment and sufficient 2-7/8 inch work string to reach total depth.

2. Run a 6-1/8 inch bit and 4-3/4 inch drill collars on the 2-7/8 inch work string to the top of the cement. Drill the cement out of the casing shoe and run the work string to total depth. Circulate any remaining drilling mud out of the well with clean fresh water containing 1% KCl.

3. Pull the work string and run a baseline temperature survey from surface to total depth for future reference.

4. Run a 7-inch test packer on the work string and set the packer approximately 100 feet above the base of the casing.

5. Run coiled tubing and jet the well with nitrogen to recover formation fluid. Continue jetting until a representative recovery rate is established and a representative sample of fluid can be obtained for analysis.

6. Upon completion of jetting operations, run a bottom hole pressure recorder with surface readout and obtain a stabilized bottom hole pressure. Pull the recorder and pull the workstring and packer out of the well.

7. Conduct a baseline injection test down the casing with filtered fresh water treated with 1% KCl or with the recovered fluid from the nitrogen jetting operation. Determine the injectivity and establish whether stimulation of the formation with acid or fracture stimulation is necessary.

8. After stimulation of the well, run a hydraulically set, retrievable packer and set it above the base of the casing/liner. Run 4-1/2 inch injection tubing, while filling the annulus with corrosion inhibited brine water with oxygen scavenger. Latch into the packer and land the tubing in the wellhead.

9. Allow the well to stabilize thermally and conduct a Standard Annulus Pressure Test to confirm internal mechanical integrity of the casing, tubing, packer, and wellhead.

10. Place sufficient water into frac tanks to conduct a 12-hour injection test at the rate previously established after stimulation. Run a surface readout bottom hole pressure transducer and set it near the base of the casing. Conduct a step rate injection test in four steps, then shut down for one hour.

11. Inject fluid for 12 hours at a constant rate while continuing to record bottom-hole pressure. Shut the well in and conduct a pressure falloff test for a time necessary to reach radial flow as determined by the derivative plot. At the completion of the pressure falloff, remove the pressure recorders from the well.

12. Begin injection into the well and run a radioactive tracer survey according to the guidelines of EPA Region V for external mechanical integrity. Develop a fluid distribution profile from the moving surveys.

13. Rig down completion equipment and install the wellhead to secure the well while obtaining final permits for injection.

Estimated timetable for drilling, logging, and formation testing

Table L-1

Proposed open-hole and cased hole logs

The proposed logging program is detailed in Table L-2. Multiple logging runs in the open hole may be required to evaluate the potential intervals available for injection.

Proposed mechanical integrity testing (cement bond logs, radioactive tracer log, and temperature, noise or oxygen activation log are required prior to injection of waste)

The well will be tested to demonstrate mechanical integrity as required by the guidelines of EPA Region V. Cement bond logs will be run on each casing string after the cement has cured. Each casing string will be pressure tested prior to drilling any new hole below the shoe joint.

A baseline casing inspection log will be run on the final casing string from total casing depth to surface. A baseline temperature survey will be conducted on the final casing and open-hole interval prior to the injection of significant volumes of water to provide a basis of comparison to future temperature surveys that may be run for demonstration of mechanical integrity.

After the injection tubing and packer have been installed, a radioactive tracer survey will be conducted to demonstrate external mechanical integrity of the cemented casing and the containment of injected fluid.

All tests will be conducted according to the most current edition of EPA Region V guidelines for mechanical integrity testing.

Proposed Buffer Fluid and Volume, if any

After recovering samples of the formation water in the intended injection interval, compatibility tests will be run with samples of the intended waste stream. The samples will be tested at simulated bottom hole conditions to determine if precipitates form under those conditions. If the results are favorable, then no buffer fluid will be needed. If the results are in doubt, a volume of buffer fluid will be determined, based on the compatibility results to minimize direct contact of the connate water and the injectate.

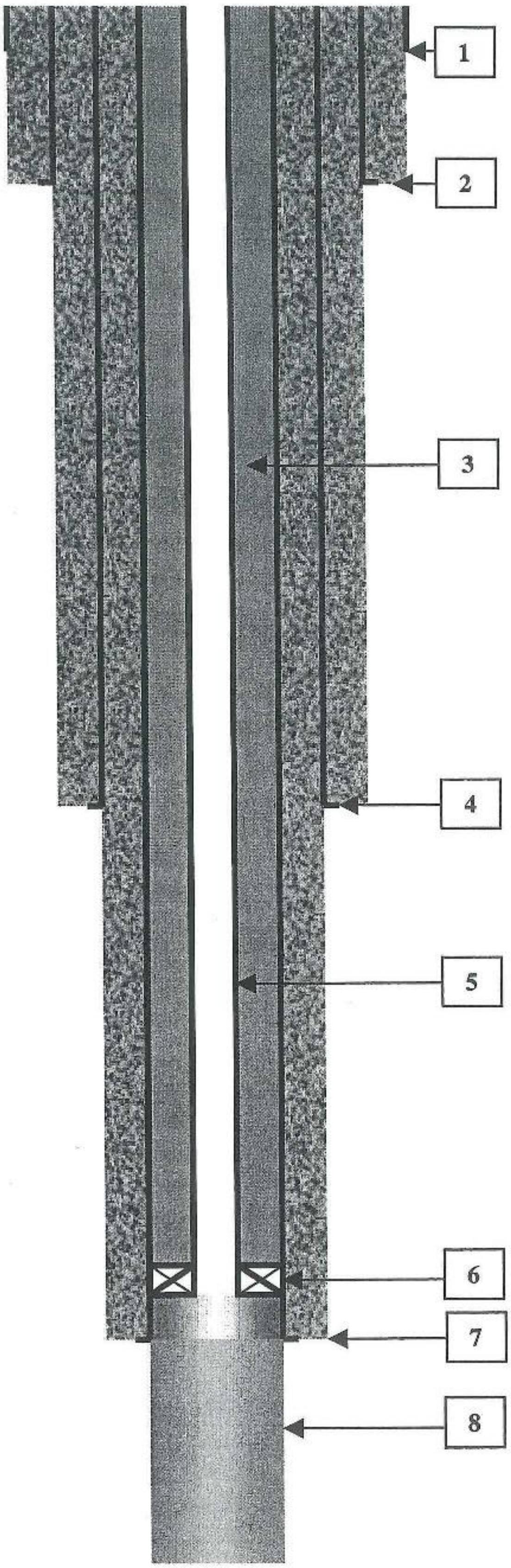
SUBSURFACE

TABLE L-1
ESTIMATED TIMETABLE FOR DRILLING, LOGGING, AND TESTING

Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Days	7	14	28	37	48	58	69	79	90	100	111	121	132	142	153	163	174	184	195	205	216	226	237
Build Location and Mobilize																							
Drill Surface Hole and Set Casing																							
Drill Pilot Hole to 3000 ft																							
Allowance for Formation Testing																							
Drill Pilot Hole to 5000 ft																							
Drill Pilot Hole to 7000 ft																							
Allowance for Formation Testing																							
Open Hole and Run 9-5/8 Casing																							
Drill Final Hole to 9000 feet																							
Drill Final Hole to 11000 feet																							
Drill Final Hole to 13000 feet																							
Run and Cement Casing or Liner																							
Test and Complete Selected Interval																							

TABLE L-2
PROPOSED OPEN HOHLE AND CASED HOLE LOGS AND MECHANICAL INTEGRITY LOGGING TESTING PROGRAM

Borehole/Casing Description and Intervals	Proposed Open Hole Logs	Proposed Cased Hole Logs
Conductor Casing (20-inch to 75 feet BGL)	None	None
Surface Hole (17-1/2 inch to 500 feet) Surface Casing (13-3/8 inch)	Spontaneous Potential Gamma Ray Resistivity Comp. Neutron Density Comp. Formation Density 4-Arm Caliper	Cement Bond Variable Density Gamma Ray Temperature
Intermediate Interval in 8-3/4 inch pilot hole (3000 feet to 7000 feet with depth determined by drilling evaluation) 9-5/8 inch casing set to depth determined by drilling evaluation	Spontaneous Potential Gamma Ray Resistivity Comp. Neutron Density Comp. Formation Density 4-Arm Caliper after opening to 12-1/4 inches	Cement Bond Variable Density Gamma Ray Temperature
Final Interval 8-3/4 inch hole (All open hole from 3000 feet to 12000 feet as determined by drilling evaluation with possible multiple runs) 7-inch Casing or Liner (Interval to be Determined)	Spontaneous Potential Gamma Ray Resistivity Comp. Neutron Density Comp. Formation Density 4-Arm Caliper Fracture Identification Log Long Spaced Sonic Log	Cement Bond Variable Density Gamma Ray Temperature
Completion Logs Surface to Total Depth Including Both Cased and Open Hole Intervals		Baseline Differential Temperature Survey Bottomhole Pressure Falloff Test Radioactive Tracer Survey Post-injection Differential Temperature Survey



1. Conductor Casing: 20", 94 ppf, 0.438" wall, H-40, STC (or Welded). Driven or set in 26" augured hole to 75" BGL

2. Surface Casing: 13-3/8", 61 ppf, J-55, STC in 17-1/2" hole at 500' BGL. Annulus cemented to surface with Premium cement as detailed in Table M-1. Cement volume based on 120% of the annular volume calculated from open-hole caliper log.

3. Injection Tubing/Casing Annulus: Filled with corrosion inhibited brine water of specific gravity 1.1 to 1.2.

4. Intermediate Casing: 9-5/8" in 12-1/4" hole as detailed in Table M-2. Design based on setting depth to be determined between 3000 feet and 7000 feet. Annulus to be cemented to surface in one or two stages as dictated by setting depth. Cement volume based on 120% of annular volume calculated from the open-hole caliper log.

5. Injection Tubing: 4-1/2", 11.6 ppf, L-80, LTC with corrosion resistant inner lining.

6. Injection Packer: 7" by 4-1/2", hydraulically set packer with latching seal assembly.

7. Long String Casing or Liner: 7", 26 ppf, N-80, LTC in 8-1/2" hole. Casing setting depth to be determined during drilling. Target depth is at the top of the primary injection interval as determined by open-hole logs, cores, drill stem tests, and sample analysis. This string may be set as a liner, overlapping into the bottom of the intermediate casing. The annulus will be cemented to surface or to the top of the liner according to Table M-1.

8. Open Hole Completion from the base of the 7" casing (or liner) to total depth

NOT TO SCALE

SUBSURFACE — HOUSTON, TX / SOUTH BEND, IN / BATON ROUGE, LA

FIGURE M-1

Cinergy PSI

Proposed Well Schematic

DATED: 1/07/05	APPROVED BY: JF	JOB NO. 60D5675
DRAWN BY: JB	CHECKED BY: JF	SCALE: N/A

ATTACHMENT M

CONSTRUCTION DETAILS

SUBSURFACE

M. CONSTRUCTION DETAILS

Proposed construction of well, including total depth, completion type, casing sizes, types, weights, and setting depths

A schematic diagram is attached as Figure M-1 detailing the installation of the well as described in Attachment L.

Proposed cement type and amount for all casing (All casings should be cemented to surface.)

The cement design for all casing strings is shown in Table M-1. The cement chemistry has been recommended by Halliburton Energy Services. Cement volumes will be based on a minimum of 120% of the open-hole/casing annular volume as determined by a four-arm caliper measurement of the open hole.

Tubing and packer specifications, including size, type, and setting depths

The specifications for the casing, tubing, and packer are included in Table M-2. The intermediate casing has been designed for setting depths of 3,000 feet, 5,000 feet, and 7,000 feet. The alternative design allow for the setting depth to be determined at any depth between surface and 7000 feet.

Well head construction details

Please refer to Figure K-3.

Location of sample tap and female coupling for independent determination of annulus pressure

A needle valve, with a ½-inch female connection, will be installed on the tubing head outlet between the injection tubing and the casing annulus for an independent pressure gauge. An independent ½-inch tap will be provided on the flowline inlet to the well for independent measurement of injection pressure. Please refer to Figure K-3.

TABLE M-1
Specifications for Cement for all Casing Strings

Interval	Casing Size (in)	Hole Size (in)	Interva l (feet BGL)	Ideal Cement Volume x 1.2 (ft^3)	Cement Type From Halliburton Recommendation Volume to be based on 120% of caliper
Conductor	20	26	75	135	If augured use 9-sack ready mix
Surface	13-3/8	17-1/2	0-500	417	Lead Cement: Halliburton Light (or equivalent) with 3% $CaCl_2$ mixed at 13.1 ppg. Final Cement: 200 sx Standard, 3% $CaCl_2$ mixed at 15.6 lb/gal, Yield=1.21 ft^3/sk
Intermediate 1	9-5/8	12-1/4	0-3000	1127	Lead Cement: Halliburton Light (or equivalent) with 3% $CaCl_2$ mixed at 13.1 ppg. Final Cement: 200 sx Standard, 3% $CaCl_2$ mixed at 15.6 lb/gal, Yield=1.21 ft^3/sk
Intermediate 2	9-5/8	12-1/4	0-5000	1878	First Stage Lead Cement: Halliburton Light (or equivalent) with 2% $CaCl_2$ mixed at 13.1 ppg. First Stage Final Cement: 200 sx Standard, 2% $CaCl_2$ mixed at 15.6 lb/gal, Yield=1.21 ft^3/sk Second Stage Lead Cement: Halliburton Light (or equivalent) with 2% $CaCl_2$ mixed at 13.1 ppg. Second Stage Final Cement: 200 sx Standard, 2% $CaCl_2$ mixed at 15.6 lb/gal, Yield=1.21 ft^3/sk
Intermediate 3	9-5/8	12-1/4	0-7000	2629	First Stage Lead Cement (7000 ft to 4000 ft): Premium Halliburton Light (or equivalent) mixed at 13.5 ppg. First Stage Final Cement: 200 sx Premium with 3% KCl mixed at 16.4 ppg. Second Stage (4000 feet to surface) Lead Cement: Halliburton Light (or equivalent) with 2% $CaCl_2$ mixed at 13.5 ppg. Second Stage Final Cement: 200 sx Standard, 2% $CaCl_2$ mixed at 15.6 lb/gal, Yield=1.21 ft^3/sk
Long String or Liner (For liner use first stage cement only)	7	8-3/4	0-10600	2163	First Stage (12000 feet to Base of Intermediate Casing) Lead cement: Premium Halliburton Light (or equivalent) with 18% salt, 0.3% FWCA, 2% Bentonite mixed at 13.5 ppg. First Stage Final Cement: 200 sx Premium with 0.25% HR-5, 3% KCl, mixed at 16.3 ppg. Second Stage (Base of Intermediate Casing to surface) Lead Cement: Premium Halliburton Light (or equivalent) with 18% salt, 0.3% FWCA, 2% Bentonite mixed at 13.5 ppg. Second Stage Final Cement: 200 sx Premium with 0.25% HR-5, 3% KCl, mixed at 16.3 ppg.

FIGURE

SUBSURFACE

DOES NOT APPLY TO CLASS I WELLS

ATTACHMENT O

PLANS FOR WELL FAILURES

SUBSURFACE

O. PLANS FOR WELL FAILURES

The purpose of the Class I injection wells are to supply a means to dispose of water generated from a flue gas scrubbing operation. The scrubbing operation is continuous.

In the event a failure occurs to any one of the injection wells, the well will be shut-in immediately and injectate shifted to other wells or to the existing surface reservoir under permit. If it is determined that the well has lost mechanical integrity, the necessary measures will be taken to assess the causes of lost mechanical integrity, and a work plan for restoring mechanical integrity will be developed and submitted to the Environmental Protection Agency (EPA) Region V, for approval. Once regulatory approval has been obtained, the work plan will be implemented to restore mechanical integrity to the well. When mechanical integrity of the well can be demonstrated to EPA Region V, regulatory approval to restore operation will be obtained prior to resuming injection. A final report documenting the well work performed and mechanical tests run will be prepared and submitted to EPA Region V.

ATTACHMENT P

MONITORING PROGRAM

P. MONITORING PROGRAM

Waste Analysis Plan

The proposed Waste Analysis Plan is included as Appendix P-1.

Description of Monitoring and Recording System for Injection Pressure, Rate, Volume, and Annulus Pressure.

The injection wells for the Gibson Station facility are to be on-site operated. The operating system will be designed to control the well from a dedicated computer terminal with a continuous monitoring and recording system for injection pressure, rate, volume and annulus pressure. The DCS system will have an historian (HSR) capable of storing 20,000 point values from the system. These values will be collected on a SUN Blade 150, 550 MHz processor, 512 MB of dynamic RAM and an 840 GB RAID 5 storage array for historical data storage. Process values will be collected and stored at a one second interval. This should allow greater than one year of data to be available at all times from the HSR. The system will also have the capability to interface and deliver selected data to the station Pl archive at a one second or greater interval depending on point configuration in the Pl system. These values are subjected to a compression algorithm that minimizes the data storage requirements without compromising the integrity of the data. The Pl system has the capability of long term storage of process data by means of tape storage. Data that is not currently in the system can be restored as necessary from the tape archives. The HSR and Pl system will be physically located on the site at Gibson Station.

The pressure transducer for the injection pressure will be located near the wellhead. In the event the injection pressure is outside the desired pressure bounds, the computer will automatically interface with the waste treatment facility control system and send an alarm to the terminal notifying the operator.

The monitoring and recording system for the injection rate will use an inline flow meter that will be located between the injection pumps and the wellhead. Associated with the flow meter will be a volume totalizer that will keep track of the total gallons of fluid injected. In the event the injection operation is outside the desired rate bounds, the computer will automatically interface with the waste treatment facility control system and send an alarm to the terminal notifying the operator.

The pressure transducer for the annulus pressure will be located near the wellhead. In the event the annulus pressure is outside the desired pressure bounds, the computer will automatically interface with the waste treatment facility control system and send an alarm to the terminal notifying the operator.

Description of sight glass level monitoring and recording, if a seal pot system of annulus pressure maintenance is proposed.

The top 10 feet of the well annulus will be filled with diesel. The seal pot system will also be filled with diesel to prevent freezing problems near the surface. Nitrogen will be used to pressurize the seal pot. Two pressure transducers, one at the top of the seal pot and one at the bottom of the seal pot, will be used to determine the height of the liquid in the sight glass.

The annulus pressure will be maintained 100 psi above (differential) the injection pressure. A nitrogen pressure regulator will be used to regulate the annulus pressure.

Groundwater monitoring plan and quality assurance project plan.

Due to the nonhazardous nature of the injectate, neither a groundwater monitoring plan, nor a Quality Assurance Project Plan will be required.

APPENDIX P-1

SUBSURFACE

WASTE ANALYSIS PLAN

PSI ENERGY, INC.
GIBSON GENERATING STATION
OWENSVILLE, INDIANA

SUBSURFACE PROJECT NO. 60D5675

January 2005

PREPARED AND SUBMITTED BY:

SUBSURFACE TECHNOLOGY, INC.
South Bend, Indiana

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1.0 INTRODUCTION

1.1 Purpose

The PSI Energy, Inc. Gibson Generating Station, located in Gibson County, Owensville, Indiana, is applying for a permit to install and operate three Class I non-hazardous injection wells for the disposal of aqueous waste from wet flue gas de-sulfurization units associated with a coal-fired electrical power generating facility. The proposed wells will be operated under the United States Environmental Protection Agency (USEPA) Underground Injection Control program and follow federal rules and regulations as defined in 40 CFR 146.

The requirements of 40 CFR Section 146.13(b)(1) specify that any operator of a Class I underground injection well monitor and analyze the fluids injected into the well such that:

> *"The analysis of the injected fluids {shall be monitored} with sufficient frequency to yield representative data of their characteristics."*

Additionally, 40 CFR Section 146.68(a)(1) specifies that:

> *"The owner or operator shall develop and follow an approved written waste analysis plan that describes the procedures to be carried out to obtain a detailed chemical and physical analysis of a representative sample of the waste, including the quality assurance procedures used."*

This Waste Analysis Plan (WAP) fulfills the applicable requirements of the permit application process as stated in various 40 CFR sections. This document was prepared following guidance as illustrated in the USEPA Region V Underground Injection Control (UIC) Section Regional Guidance #8 issued January 21, 1994 entitled Preparing a Waste Analysis Plan at Class I Injection Well Facilities.

1.2 Waste Description and Generation

Wastewater consists of an aqueous waste from wet flue gas de-sulfurization (FGD) units associated with a coal-fired electrical power generating facility. An analysis of a sample of anticipated typical waste is included as Appendix A. Analytical results do not indicate any hazardous constituents.

1.3 Waste Storage Transportation and Disposal

The wastewater generated by the flue gas scrubber will be run through a de-watering process which will remove a marketable gypsum product. The resultant fluid will then be piped to a water treatment facility where the influent will be clarified, conditioned, filtered, and pH adjusted in order to provide an effluent that will be suitable for deep well injection. The effluent from the treatment facility will then be further filtered prior to the injection pumping system and the injection wells.

Other than required process retention times, there will be no long term storage prior to treatment or injection. Appendix B depicts a block flow diagram of the proposed process for the Gibson Station facility.

1.4 Operating Data

Estimated average injection rate while in operation: 0 - 400 gallons per minute (gpm)

Estimated injection pressures while in operation: 0 - 500 pounds per square inch (psig)

1.5 External Transport and Disposal Procedures

PSI does not anticipate any wastewater leaving PSI property. In the event of multiple well failures, wastewater will be diverted from the treatment facility, via pipeline, to the existing surface reservoir under permit.

1.6 Project Responsibility

PSI's Station Manager will have the primary responsibility to ensure all WAP conditions are met. The Station Manager is also responsible for coordination and selection of the subcontracted laboratory used to support the analyses associated with this WAP.

Heritage Environmental Services, LLC (or an equivalent laboratory) will be performing the analytical requirements of the WAP. It is the primary responsibility of Heritage to ensure that all of the laboratory QA functions are fulfilled.

2.0 SAMPLING ACTIVITIES

The following parameters will be analyzed for one or more of the following reasons:

- required to show that the waste is characteristically non-hazardous per 40 CFR 261
- required per the USEPA Region V guidance document
- required by PSI for optimal injection well system performance

2.1 Sample Parameters/Analytical Method/Sampling Frequency

PARAMETER	SAMPLING FREQUENCY
pH	Daily
Eh	Daily
Specific Conductance	Daily
Specific Gravity	Daily
Temperature	Daily

PARAMETER	ANALYTICAL METHOD	SAMPLING FREQUENCY
Arsenic	SW846-6010B	Annually
Barium	SW846-6010B	Annually
Cadmium	SW846-6010B	Annually
Chromium	SW846-6010B	Annually
Lead	SW846-6010B	Annually
Selenium	SW846-6010B	Annually
Silver	SW846-6010B	Annually
Mercury	SW846-7470A	Annually
Total Dissolved Solids	EPA 160.1	Annually
Total Organic Carbon	SW846-9060	Annually
Volatile Organics	SW846-8260B	Annually
Semi-volatile Organics	SW846-8270C	Annually

For quality control purposes, field duplicate samples will be collected, at a minimum annually, in an effort to document the effectiveness of the sampling techniques and the analytical system.

2.2 Sampling Frequency Justification

The sampling frequency presented in this WAP was based on process knowledge of the operational conditions and initial laboratory analyses of the waste stream. As the waste stream is non-hazardous, the sampling frequency proposed is a reasonable monitor of the waste stream. As historical data and process knowledge has indicated, the waste stream is consistent relative to analytical test results. As such, the frequency specified will provide the necessary monitoring to insure identification of any potential fluctuations in the stream. Additionally, this WAP allows for supplemental, or modified, sampling when system anomalies are suspected.

2.3 Sampling Location

PSI has identified a primary sampling location from which wastewater injectate will be collected. The primary sampling point, a manual spigot located at the discharge point of the final filtration unit, will be used for all specified sampling events. This spigot is located on the wastewater main discharge line, such that no other piping is connected to the main prior to the wellhead. The preliminary process flow diagram provided in Appendix B indicates the primary sampling point as the "Filtered Sample Outlet."

2.4 Sampling Protocol

The sampling protocols include the collection of operational data at the wellhead and the collection of samples at the appropriate sample points.

2.4.1 Sampling Protocol (Analytical)

Sampling will be performed quarterly. The sample will be obtained at the primary sample point by carefully opening the spigot valve to allow the sample to flush to the local sump drain for one minute. After the flush period, appropriate sample containers will be filled with the final filtered wastewater (annually a second set of containers will be filled as a field duplicate.)

Each sample container is labeled with the:

- date of collection
- time of collection
- sampler initials
- sample ID "Injection well"
- bottle sequence (1 of 3)

A Chain-of-Custody must be initiated that includes at a minimum the:

- date of collection
- time of collection
- sampler signature
- sample ID "Injection well"
- analyses to be performed
- pertinent sampling notes

2.5 Sampling Personnel

Only those PSI individuals who are thoroughly familiar with the safety and operational characteristics of the injection well system and the requirements of this document will perform or assist in sampling.

The PSI sampling staff will possess site familiar training in the proper sampling protocols specified in this WAP. Additionally, they will possess the required training and site knowledge to perform the sampling tasks safely.

PSI personnel will be primarily responsible for the operation, maintenance and corrective action documentation of the Injection well system.

PSI sampling personnel will be primarily responsible for coordinating sampling activities with the lab, performing sampling as outlined in Section 2.4, preparing and completing all required sample labels and chain-of-custody (COC) and transporting samples to the laboratory for analysis.

2.6 Chain-of-Custody

The following COC procedures have been developed to insure that all samples collected remain intact and representative, until all analytical procedures are conducted. These procedures include both field and laboratory custody requirements.

2.6.1 Field Custody Procedures

Sample containers are labeled as indicated in Section 2.4 immediately after collection. A COC is initiated in the field at the time of collection. After signature, the bottom copy of the COC form is removed and retained by PSI Station personnel. The samples and COC are sent by the field sampling technician to the Heritage Indianapolis laboratory.

Upon receipt of the sample at Heritage, the COC is signed as received by the sample custodian, the sample information is recorded in a computer log and the sample is released to the laboratory for testing.

2.6.2 Laboratory Custody Procedures

Heritage Environmental Services, LLC has incorporated strict procedures for sample custody. The entire Heritage QA/QC document is attached as a CD. These guidelines were established to maintain the custody of samples in the laboratory and the legal validity of results generated.

The sample custody procedure outlines the general procedures utilized in the processing of all samples received. The following is to be considered a minimum requirement. The attached CD contains specific details utilized by Heritage for sample receipt, login, storage, internal sample transfer, storage, analysis, and disposal.

2.6.3 Sample Custody Procedure

This procedure is designed to outline the general processes used to initiate and maintain sample custody for samples received at the laboratory. These procedures have been instituted to insure that proper sample custody has been established upon receipt and that this custody is maintained during the entire analytical process. Detailed procedures are specified in the attached CD.

General Procedure:

When a sample cooler is received, a sample login is immediately initiated. The cooler is inspected externally to determine if any obvious leakage has occurred. The cooler seals are broken and the COC is removed. The cooler contents are inspected for obvious damage or leaks. An infrared thermometer is used to measure the temperature of the samples, and the receipt temperature is recorded on the COC. Upon completion of inspection, the COC is checked against the bottles received. The COC is reviewed and signed.

All samples received at the laboratory are logged into a computerized laboratory data management system, which assigns a unique laboratory sample number to each sample. Each container for a given sample is issued a unique container identification number.

Login personnel determine which analysis is required for a given sample from the information provided on the COC. The COC information is entered into the laboratory data management system.

The sample COC, check list, and any other shipping paperwork are placed into a project file, which is then given to the applicable laboratory project manager who verifies the receipt of the sample, COC information, and analyses logged into the database system.

Labels are generated for each sample container. These labels are durable, water resistant, and printed with indelible ink. The labels include the following information:

- sample number
- client name
- client sample ID
- date received
- date collected
- preservative
- required tests from that container

The sample number serves as the container identification number. Where multiple containers are received for a given container type, they are further identified with a container identification in the format of "1 of 3". This sample number and container number format provides a link between sample analysis and the container used.

Samples are placed in a cooler (maintained at 4°C). Access to the cooler and samples are limited to the technical staff of the laboratory. Sample security is maintained through secured limited access areas.

2.7 Bottles and Preservatives

All samples will be collected in appropriate sample containers supplied by the laboratory. Depending on the analysis involved, chemical preservatives may or may not be necessary. Samples will be transported on ice and stored refrigerated at 4 +/- 2 deg C.

2.8 Sample Transport

All samples will be packaged in a cooler with sufficient ice and packing material. Caution will be taken during handling and transport of the samples to ensure that the sample containers are not damaged.

3.0 ANALYSIS INFORMATION

3.1 Analytical Procedures

Analytical methods are listed in Section 2.1 of the WAP. It is understood that these are the base parameters, and circumstances may necessitate the need for additional testing.

The attached CD details in Table 5.1 aspects of the analytical parameters, including typical lower quantitation limits, analytical method references, units of reporting, and holding times.

3.2 Parameter and Quantitation Limit Justification

The parameters selected for analysis under the WAP are representative of those necessary to monitor and characterize the FGD waste stream. These parameters are analyzed to determine compliance with the UIC permit, and to insure that the waste stream characteristics are consistent.

The parameters selected for analysis under this WAP are consistent with the requirements of the UIC permit. The provision for waste recharacterization, provided in this WAP, eliminates the need for additional routine analyses.

The quantitation limits (outlined in Table 5.1 in the attached CD) reflect realistic levels of detection that can be reasonably reproduced to insure permit compliance, and to allow for the obvious effects of the sample matrix. These limits should be achievable for the analysis indicated, however, when not obtainable, adequate documentation for matrix interference will be provided.

3.3 Waste Recharacterization

In the event that a significant change is suspected or detected in the waste stream, a provision for waste recharacterization will be implemented. An immediate sampling / resampling of the waste stream will be performed and analyzed for all parameters specified in Section 2.1. This sample will be drawn from the primary sampling point as described in Section 2.3.

Waste recharacterization will be used to determine that the waste being injected into the Injection well system is stable, and that any waste stream variation will not impact the underground injection process. It is anticipated that a recharacterization process will take place at least annually to assure the waste stream remains non-hazardous.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Field QA/QC

The following general procedures will be followed by sampling personnel:

4.1.1 Equipment Blanks

Samples for this WAP are drawn from a free flowing spigot, therefore all sampling equipment and containers are dedicated. Equipment Blanks will not be required.

4.1.2 Trip Blanks

A trip blank will be prepared by the laboratory using preserved containers (as applicable) and filled with reagent grade water. The trip blank will follow the sample containers to the site and through the entire collection and transportation process.

4.1.3 Field Duplicates

Field duplicates are representative samples taken at the same time of normal sampling using similar sampling techniques. The field duplicates are identified in a generic fashion to limit laboratory knowledge of the sample source. Field duplicates will be analyzed for all parameters. Field duplicates will be analyzed at a frequency equivalent to at least one (1) per calendar year. Additional field duplicates may be required to investigate specific parameters or analytical processes.

4.2 Laboratory QA/QC

This section presents the general QA/QC requirements applicable to the analysis of environmental samples, as well as the methods for assessing data quality. The purpose of the QA/QC program is to produce data of known quality that is legally defensible, satisfies applicable data quality objectives (DQOs), and meet or exceed the requirements of the WAP.

Performance of all analytical methods is monitored to assess the accuracy and precision of the procedure. Specific quality control checks are designed to provide the necessary information for method assessment.

The following general elements apply to the chemical analyses performed in the laboratory. ***Note that Heritage Environmental Services, LLC has provided a lengthy, detailed QA/QC program for their specific operations that is attached to this WAP as a compact disc (CD).***

4.2.1 Elements of Quality Control - Chemical

A preparation batch is a group of samples that are carried through an applicable preparation technique (e.g. digestion, distillation, or extraction) at the same time using the same reagents and conditions. An analytical batch is a batch of samples that are analyzed using the same instrument and conditions within the same time period. The identity of each batch is unambiguously recorded as a unique "Batch ID" so that a reviewer can identify the QC samples associated with a group of samples.

The type of QC samples that may be utilized and their use are identified below. The specifics regarding frequency, acceptance criteria, and corrective action are included in the attached Heritage CD. Specifics regarding the requirements of these QC samples are detailed in the individual standard operating procedures.

4.2.2 Calibration

Instruments and support equipment are calibrated in accordance with the referenced analytical methods. Details of calibration procedures are contained in the laboratory SOPs. For the analyses selected, all target analytes are included in the initial and continuing calibrations regardless of their need in a given environmental sample.

If the calibration acceptance criteria are not met, the operating curve may be narrowed either by eliminating the low point or high point of the curve (providing all project criteria are still met.) For multi-analyte calibrations, specific analytes may be eliminated from the low or high points. Otherwise, the entire calibration curve is repeated. Elimination of any of the inner levels of the calibration in order to meet QC acceptance criteria is allowed provided that all analytes are eliminated in that level and the required minimum number of calibrated levels remain.

4.2.3 Surrogates (SURR)

Surrogates are used to evaluate accuracy, method performance, and extraction efficiency in organic procedures. Surrogates shall be added to environmental samples, quality control samples, and blanks.

4.2.4 Initial Calibration Verification (ICV)

A second source standard containing all target analytes is analyzed after each initial curve, to verify the validity of the calibration. This standard must be from a separate source or lot number from that used for calibration. Unless specified in the reference method, the ICV is at a concentration near the midpoint of the calibration range.

If the acceptance criteria are not met for the ICV, corrective action steps will include the following. When deemed appropriate, the analyst may take lesser corrective action.

- perform corrective action (e.g. prepare new standard, rinse system, etc.)
- analyze another calibration verification. If acceptance criteria are not met in this second consecutive (immediate) calibration verification, then perform one of the following. Either,
- demonstrate performance after corrective action with two consecutive successful calibration verifications, or
- a new initial instrument calibration must be performed.

The acceptance criteria must be met before samples can be analyzed. However, sample data associated with unacceptable calibration verification may be reported if the verification indicates high bias and the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

4.2.5 Initial Calibration Blank (ICB)

A reagent blank is analyzed after the ICV and prior to the analysis of environmental samples. A blank may also be analyzed after high concentration samples to demonstrate that carryover contamination does not exist.

Samples associated with an ICB indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

4.2.6 Interference Check Sample (ICS)

Interference check samples are used in inductively coupled plasma analyses to verify background and inter-element correction factors.

Samples associated with an ICS indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

4.2.7 Method Blank (MB)

The method blank goes through all applicable preparation steps and is used to document non-contamination of the entire analytical process.

The MB is considered a batch control parameter. Samples associated with a MB indicating high bias are re-prepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration despite the MB result, or where the project DQOs are met and an appropriate qualifier is reported.

4.2.8 Laboratory Control Sample (LCS)

The LCS is prepared with analyte-free water or, where available, a purchased solid matrix spiked with representative analytes. The LCS shall be spiked with a second source standard at a level near or below the midpoint of the calibration curve for each analyte. This QC sample shall be carried through the entire preparatory and analytical procedure to document the accuracy of the entire analytical process.

The LCS is considered a batch control parameter. Samples associated with a LCS that fails to meet the acceptance criteria for recovery are re-prepared and analyzed. The only exceptions are samples that indicate a non-detectable concentration when the LCS indicates high bias, or where the project DQOs are met and an appropriate qualifier is reported.

4.2.9 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A matrix spike and matrix spike duplicate are separate aliquots of sample spiked with known concentrations of analyte using a second source standard. The spiking occurs prior to sample preparation and analysis. Samples used for the MS/MSD are chosen at random. This allows for the evaluation of all sample matrices over time. The MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve.

The MS/MSD are matrix-specific quality control samples and are used to assess the bias for accuracy and precision of a method in a given sample matrix. The MS/MSD accuracy recovery is not solely used to assess batch control.

Samples having an indigenous concentration greater than or equal to 4 times the spiked amount are considered not applicable for spike analysis at that level. Where the sample chosen for MS/MSD analysis is one of a group of samples submitted from a site with homogeneous character and the MS/MSD require that the sample is re-prepared and analyzed, all samples from that Sample Delivery Group should be re-analyzed under similar conditions. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered matrix specific for that sample and the results yielding better recovery are reported with an appropriate qualifier.

4.2.10 Duplicate (DUP)

Applicable to analyses where MS/MSD are not, duplicate samples are analyzed using identical recovery techniques and treated in an identical manner. Duplicate sample results are used to assess the precision of the entire analytical process. Samples used for the DUP are chosen at random. This allows for the evaluation of all sample matrices over time.

The DUP is a matrix-specific quality control sample and is used to assess the bias of a method due to a given sample matrix. The DUP is not used to solely assess batch control. If the acceptance criteria (%RPD) are not met, the sample and its duplicate must be re-prepared and analyzed. Relative Percent Difference is calculated only where the two values are greater than or equal to 5 times the PQL. If the values are below 5 times the PQL, the acceptance criteria are ± 1 PQL of each other.

Where the sample chosen for duplicate analysis is one of a group of samples submitted from a site with homogeneous character and the DUP requires that the sample is re-prepared and analyzed, all samples from that Sample Delivery Group should be re-analyzed under similar conditions. If the acceptance criteria are not met in two separately prepared analyses, the failure is considered matrix specific for that sample and the results yielding better recovery are reported with an appropriate qualifier.

4.2.11 Post-digestion Spikes (PDS)

A PDS is applicable only to digested metals analyses and those general chemistry (wet chemistry) analyses that include a preparation step (e.g. cyanide, nitrogen - ammonia, and phenolics). A post-digestion spike may be analyzed to assist in the assessment of matrix interference when the MS and MSD fail to meet the accuracy acceptance criteria. In addition, a PDS can be used as a troubleshooting tool. The spiking solution is added to a sample aliquot just prior to analysis thereby evaluating the matrix effect on the analysis process only and not the preparation portion. Samples having an indigenous concentration greater than or equal to 4 times the spiked amount are considered not applicable for spike analysis at that level.

If the MS/MDS fail to meet the accuracy acceptance criteria and the PDS is within the acceptance criteria, matrix interference should be suspected. If the MS/MSD and PDS fail to meet the accuracy acceptance criteria, matrix interference is probable and the sample, MS/MSD, and PDS should be reprepared and analyzed. A smaller sample size should be considered as means to negate the apparent matrix interference.

4.2.12 Serial Dilution (SD)

As a troubleshooting tool, it may be necessary to analyze a serial dilution of a sample. The results of a 1:5 serial dilution should agree with each other within 5% (unless stated otherwise in the reference method). These criteria are for evaluating the matrix effect in a new or unusual matrix and not for comparing results for a sample diluted because it was above the calibration range of the instrument.

4.2.13 Continuing Calibration Verification (CCV)

A second source standard containing all target analytes is analyzed to verify that the calibration curve remains valid. This standard must be from a separate source or lot number from that used for calibration. Unless specified in the reference method, the ICV is at a concentration equivalent to the midpoint of the calibration range.

If the acceptance criteria are not met for the CCV corrective action steps include the following. When deemed appropriate, the analyst may take lesser corrective action.

- perform corrective action (e.g. prepare new standard, rinse system, etc.)
- analyze another calibration verification. If acceptance criteria are not met in this second consecutive (immediate) calibration verification, then perform one of the following. Either,
- demonstrate performance after corrective action with two consecutive successful calibration verifications, or
- a new initial instrument calibration must be performed.

Sample data associated with unacceptable calibration verification may be reported if the verification indicates high bias and the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

4.2.14 Continuing Calibration Blank (CCB)

A reagent blank is analyzed after the CCV. A blank may also be analyzed after high concentration samples to demonstrate that carryover contamination does not exist.

Samples associated with a CCB indicating high bias may be reported if the samples indicate non-detectable concentration, or if the project DQOs are met and an appropriate qualifier is reported.

4.2.15 Control Charts/Tabulations

Control chart-type data are retained by the laboratory for all quality control sample types. Where allowed by the reference method, laboratory generated acceptance limits may be statistically prepared for Surrogate recovery, LCS recovery, MS recovery for accuracy, and MSD/DUP recovery for precision. Statistical outliers are removed and a minimum of the 50 most recent data points is used to update the limits. When used, lab generated acceptance limits are updated on a minimum annual basis. Control limits are established at the average plus-and-minus three standard deviations ($X \pm 30_{n-1}$) unless otherwise required in the reference method.

4.2.16 Subsampling

When removing a portion of an environmental sample, appropriate care and technique is used in order to obtain a representative sub-sample. For water samples this includes thoroughly shaking the sample container in order to mix any solids. It is appropriate to shake filtered groundwater samples as any particulate in the filtrate is from the original sample. For solid and semi-solid samples this includes stirring the sample in order to homogenize any stratified layers within the sample container. These techniques do not apply to removing an aliquot for the analysis of total organic halides (TOX), or total organic carbon (TOC).

4.2.17 Sample Containers

Most containers are purchased certified clean from a commercial vendor. These containers are ready for use and require no additional monitoring prior to use. Containers that are purchased without certification will be verified clean prior to shipment.

4.3 Calibration Procedures - Laboratory Analyses

All analytical calibration procedures utilized at Heritage, have been developed to meet or exceed the requirements specified in SW-846, (current) edition, and EPA 600/4-79/020. These procedures are strictly adhered to at all times.

4.3.1 Accuracy and Traceability of Calibration Standards

All standards and reagents are tracked from their initial preparation through their use in the preparation and analytical batches. Standards purchased from an outside vendor are, where available, traceable to the National Institute of Standards Technology (NIST). A Certificate of Analysis, or similar document of traceability, is kept in the appropriate standards preparation log. Purchased standards may be used at their prepared and labeled concentration without further verification.

Standards preparation and reagent preparation logbooks are maintained throughout the laboratory. Each logbook is labeled with the laboratory name, unique name/purpose of the logbook, logbook number, the "start date" and the "end date".

Each stock standard, subsequent dilution, and prepared reagent is given a unique tracking number. When preparing dilutions of a standard the following information is included in the standards log:

- standard source lot number
- standard name
- expiration date
- initials of the preparer
- date prepared
- detailed information of the volume/mass used
- final volume prepared
- diluent
- prepared concentration

The expiration date of a prepared standard is that date on which the stock solution expires. In mixes where there is more than one expiration date for the stock solutions, the earliest date is chosen as the expiration date for the entire mix. Each container is labeled with standard or reagent name, concentration, tracing number, and the expiration date. Containers too small for a label with the required information are labeled with a minimum of the logbook reference number and expiration date. Expired standards are discarded and are not used for the generation of analytical data. Standards are prepared using glassware and delivering devices of known and acceptable accuracy.

4.4 Data Reduction, Review, Reporting - Field Analyses

Data reduction for field analyses involves the direct recording of values from various meters and instruments. All results generated from field analyses consist of values read directly from continuous monitoring meters. Therefore, no calculations are required in producing the final reported results.

All field analysis raw data is reviewed by PSI Station personnel for accuracy and completeness. Particular attention is paid to the maximum and minimum values recorded, as these values are compared to permit limits for compliance purposes.

4.5 Data Reduction, Review, Reporting - Laboratory Data

Data reduction involves the handling of raw sample data including, but not limited to, detector response, electrode potential readings, titrant volumes, and gravimetric measurements to achieve final sample concentrations. Automated systems are used for calculation and reduction wherever feasible.

4.5.1 Data Review

A two-tier technical review of all data is performed and documented.

4.5.1.1 1st Level Technical Review

The laboratory technician performing an analysis reviews all of their own data and is responsible for ensuring that the calculations were properly performed and the quality control requirements were met. A data review checklist is initiated by the technician to document this review. The data review checklist is then given to a peer knowledgeable with the current requirements of that analytical procedure, a senior technician, unit supervisor, or the QA/QC director.

4.5.1.2 2nd Level Technical Review

A peer, senior technician, unit supervisor, or the QA/QC director reviews the data by repeating the verification performed by the laboratory technician. This step is documented through use of the data review checklist.

Acceptable data is then available for review in the laboratory data management system. This is performed through the "QA Validation" function of the database. Anyone able to perform the 1st Level or 2nd Level Technical review can "validate" the data in the database. This step approves the data for release.

4.5.2 Project Manager Review

Before the data is released , a project manager will review all final reports for consistency and completeness to ensure that the data meet the overall data quality objectives of the project. This review is intended to verify that those analyses requested on the COC have been performed, the sample information is accurate, and the appropriate data qualifiers have been added.

4.5.3 Quality Assurance Review

In addition to the tiered review process, the quality assurance department will periodically perform data audits. These audits, required as part of the laboratory quality systems audit program, can be performed for the generation of reports that include quality control data, and as a troubleshooting measure. Batches that are reviewed are chosen on random basis and recreate the calculations of all samples in a given batch.

4.5.4 Reporting

For each sampling event/sample delivery group, Heritage will prepare an analytical report. The analytical report, accompanied by a cover letter will generally contain the following elements.

- Laboratory name, address, and phone number
- Title of "Analytical Results"
- Date reported
- Client name (with address on the cover letter)
- Client project ID
- Work Order and Sample Number
- Client sample identification and description
- Client defined matrix
- Collection date and received date
- Analyte
- Result (at client requested reporting limits and units)
- Reporting limit
- Units
- Applicable data qualifiers and dilution factor
- Date of analysis
- Analytical method reference
- Date of sample preparation
- Analyst initials
- Page numbering

The original chain-of-custody form and the login checklist will be returned with each report. Any deviations from the requirements of the laboratory sample acceptance policy will be noted in the final report on either the cover letter or the login checklist.

4.5.4.1 Report Archive

Analytical reports generated as part of the Injection well waste analysis sampling will be archived by Heritage. Individual reports will be maintained in the work order file organized by work order number. In addition to the final report archive, Heritage will maintain a complete data level IV QC data package for each sampling event associated with this Waste Analysis Plan. The QC documentation will be maintained by Heritage and made available to PSI upon request.

4.6 Internal Laboratory Audits

The purpose of auditing is to identify whether the lab is generating scientifically sound and defensible data, and that daily operating systems meet the requirements of this quality assurance plan. It is the responsibility of the Heritage laboratory QA Director to perform periodic performance audits and system audits.

4.6.1 Performance Audits

Performance audits are conducted periodically throughout the year. Performance audits include proficiency testing samples and detailed data reviews. Findings from these audits are used to evaluate the defensibility and data quality produced by the analytical system. Randomly selected samples from various test methods are evaluated in this process. Deficiencies from these audits are discussed with the analyst. Copies of the reports from these audits are forwarded to the unit supervisors and summarized for upper management in the annual system audit report.

4.6.2 System Audits

A systems audit is performed on a minimum annual basis. The systems audit is a comprehensive review of the overall quality and measurement system. The purpose of these audits is to confirm compliance with the requirements of the Quality Assurance Plan, and to assess the applicability of the quality system to other certification and regulatory programs. Systems audits identify the presence of the necessary organization, facility, and quality systems needed to provide evidence of the laboratory's capability and competence. Copies of the reports from these audits are forwarded to upper management.

4.7 Laboratory Corrective Action Procedures

Corrective action is necessary whenever deviations from requirements of the quality system occur. System corrective action is described in this section.

4.7.1 System Corrective Action

The QA department typically initiates corrective action. This type of action is usually initiated due to poor performance audit results, poor system audit results, or unacceptable results on performance testing samples. Either the unit supervisor or their designee is responsible for investigating the problem and determining the corrective action needed. When the source of the problem has been identified and corrective action suggested, a written record is completed, evaluated and, if appropriate, approved by the unit supervisor and QA department. Documentation of each corrective action is kept on file. The forms used are numbered and monitored by the QA department to ensure that out of control events and actions are documented, and that the corrective actions are appropriate, effective, and complete.

Regardless of the source or projected impact on the system failure, the following systematic approach is used in developing a suitable corrective action. The emphasis of the corrective action is to prevent the problem from reoccurring.

- Define the problem
- Establish the root cause of the problem
- Determine the needed action to resolve the problem and eliminate the root cause
- Assign responsibility for implementing corrective action
- Verify the corrective action has been implemented and has eliminated the problem

5.0 SAFETY

5.1 Safety Guidelines

Sampling activities at PSI will be conducted with the proper personal protective equipment (PPE). Sampling activity will generally be conducted using Level D PPE. The following is a list of specific items to be used by field personnel as defined by Safety Level D:

- Hard Hat
- Safety Glasses with side shields
- Safety shoes
- Heavy work clothes covering legs, shoulders and arms
- Safety gloves

Caution must be exercised at all times when performing sampling activities. In and around the area of the Injection well system various mechanical hazards exist.

APPENDIX A

ANALYTICAL RESULTS OF TYPICAL WASTE STREAM

SUBSURFACE

Complete Water Analysis w/ Common Metals

PENCOR ID No. 30362-01

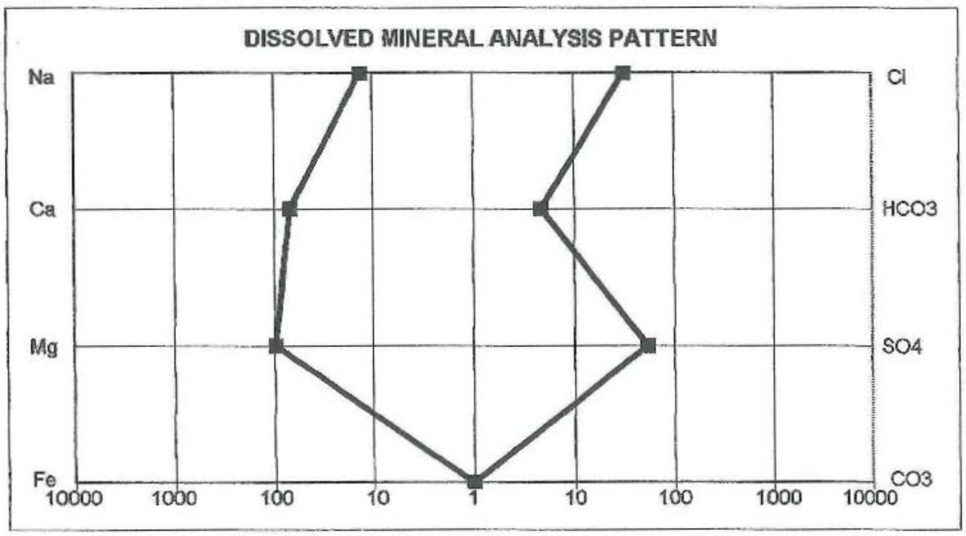
Cations			Anions		
	mg/l	me/l		mg/l	me/l
Sodium, Na	305	13.27	Chloride, Cl	1138	32.10
Potassium, K	41	1.05	Alkalinity as HCO3	285	4.67
Calcium, Ca	1372	68.46	Carbonate, CO3	0	0.00
Magnesium, Mg	1176	96.77	Sulfate, SO4	2601	54.19
Barium, Ba	<0.005	0.00	Bromide, Br	<1.0	0.00
Iron, Fe (Dissolved)	<0.01	0.00	Iodide, I	<2.0	0.00
Iron, Fe (Total)	187	6.70	Sulfide, S	0	0.00

Additional Ions

Boron	294.0	81.59	Nickel	0.2	0.01
Copper	0.1	0.00	Strontium	11.2	0.26
Manganese	<0.002	0.00	Zinc	<0.004	0.00
Silicon	12.6	0.90	Vanadium	0.5	0.02
Lead	<2.2	0.00	Chromium	0.3	0.01

Other Properties

pH Value @ 25 °C	6.84	Stability Index @ 100 °F	-1.13
Specific Gravity 60 / 60 °F	1.0154	Stability Index @ 200 °F	0.60
Resistivity (Ohm-Meter) @ 75 °F	0.83	% Deviation in Meq. Balance	1.58
Total Dissolved Solids, ppm	6655	% Deviation in TDS	4.89
Comments	Mercury in Wastewater = 0.0122 mg / l		



E...rocorp Inc.
Subsurface Technologies

Hydroclo... Wastewater
for the Powerplant Project
Solids at bottom of bucket

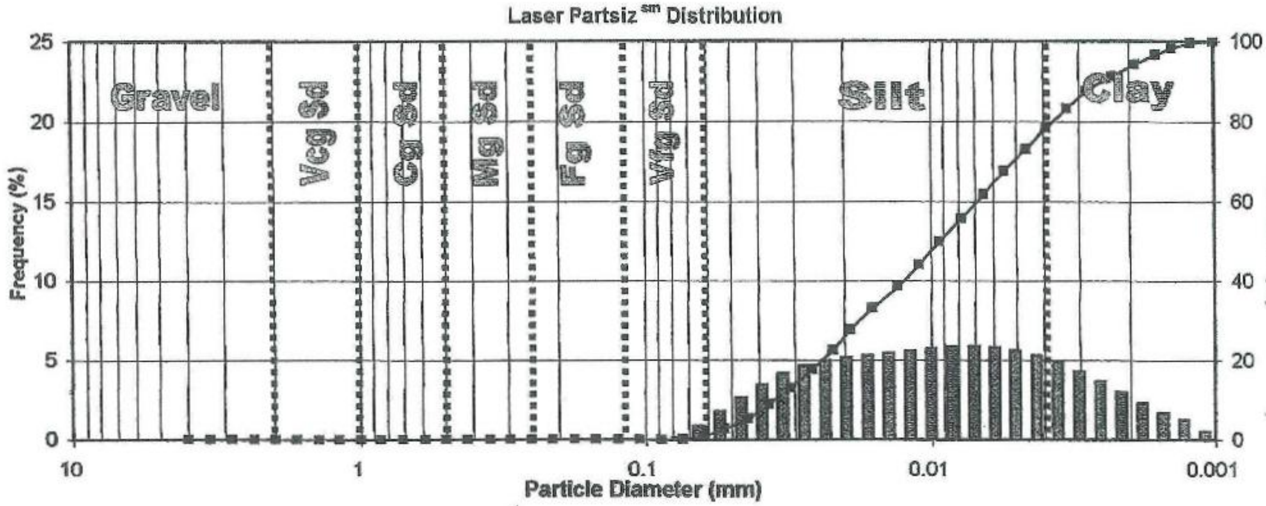
PARTSIZ^{SM} ANALYSIS

SMPL NO	DEPTH (ft)	Kair (mD)*	SAND % GRVL	VCRS	CRS	MED	FINE	VFIN	SILT % CRS	MED	FINE	VFIN	CLAY (%)	Vsh (%)	Cs (m2/cc)	MEAN (µ)	LITHOLOGY*
1	1.00	0.13	0.0	0.0	0.0	0.0	0.0	1.0	12.0	20.1	22.6	22.6	21.6	87	1.21	12	Shale

Footnotes:

* Lithology determined using laser particle size distribution.

EXTENDED RANGE PARTSIZ℠ ANALYSIS



GRAIN SIZE DISTRIBUTION	MESH	PHI	INCH	MM	SEP	SEP	CUM
	5	-2.00	0.1575	4.0000	0.0		0.0
	6	-1.75	0.1323	3.3600	0.0		0.0
	7	-1.50	0.1114	2.8300	0.0		0.0
	8	-1.25	0.0937	2.3800	0.0		0.0
GRAVEL	10	-1.00	0.0787	2.0000	0.0	0.0	0.0
	12	-0.75	0.0661	1.6800	0.0		0.0
	14	-0.50	0.0555	1.4100	0.0		0.0
	16	-0.25	0.0469	1.1900	0.0		0.0
VCRS SD	18	0.00	0.0394	1.0000	0.0	0.0	0.0
	20	0.25	0.0335	0.8500	0.0		0.0
	25	0.50	0.0280	0.7100	0.0		0.0
	30	0.75	0.0236	0.6000	0.0		0.0
CRS SD	35	1.00	0.0197	0.5000	0.0	0.0	0.0
	40	1.25	0.0165	0.4200	0.0		0.0
	45	1.50	0.0138	0.3500	0.0		0.0
MED	50	1.75	0.0117	0.2970	0.0		0.0
SAND	60	2.00	0.0098	0.2500	0.0	0.0	0.0
	70	2.25	0.0083	0.2100	0.0		0.0
	80	2.50	0.0070	0.1770	0.0		0.0
FINE	100	2.75	0.0058	0.1490	0.0		0.0
SAND	120	3.00	0.0049	0.1250	0.0	0.0	0.0
	140	3.25	0.0041	0.1050	0.0		0.0
	170	3.50	0.0035	0.0880	0.0		0.0
VFINE	200	3.75	0.0029	0.0740	0.1		0.1
SAND	230	4.00	0.0024	0.0620	0.9	1.0	1.0
	270	4.25	0.0021	0.0530	1.8		2.8
	325	4.50	0.0017	0.0440	2.6		5.4
CRS	400	4.75	0.0015	0.0370	3.5		8.9
SILT	500	5.00	0.0014	0.0310	4.2	12.0	13.0
		5.25	0.0010	0.0260	4.7		17.7
		5.50	0.0009	0.0220	5.0		22.7
MED		5.75	0.0007	0.0190	5.2		27.8
SILT		6.00	0.0006	0.0160	5.3	20.1	33.1
		6.25	0.0005	0.0130	5.4		38.6
		6.50	0.0004	0.0110	5.6		44.2
FINE		6.75	0.0003	0.0093	5.7		49.9
SILT		7.00	0.0003	0.0078	5.8	22.6	55.8
		7.25	0.0002	0.0065	5.9		61.6
		7.50	0.0002	0.0055	5.8		67.5
VFINE		7.75	0.0002	0.0046	5.6		73.1
SILT		8.00	0.0001	0.0039	5.3	22.6	78.4
		8.25	0.0001	0.0033	4.9		83.3
		8.50	0.0001	0.0028	4.3		87.6
		8.75	0.0001	0.0023	3.7		91.2
		9.00	0.0000	0.0019	3.0		94.2
		9.25	0.0000	0.0016	2.3		96.5
		9.50	0.0000	0.0014	1.7		98.2
		9.75	0.0000	0.0012	1.2		99.5
		10.00	0.0000	0.0010	0.5	21.6	100.0

SORTING PARAMETERS

PERCENTILES:

	mm	inches	phi
5	0.0454	0.0018	4.4621
10	0.0354	0.0014	4.8209
16	0.0278	0.0011	5.1676
25	0.0206	0.0008	5.5979
50	0.0093	0.0004	6.7523
75	0.0043	0.0002	7.8453
84	0.0032	0.0001	8.2817
90	0.0025	0.0001	8.6631
95	0.0018	0.0001	9.1193

SURFACE AREA (m^2/cc) : 1.2081

STD DEVIATION (mm) : 0.0123

STD DEVIATION (inches) : 0.0005

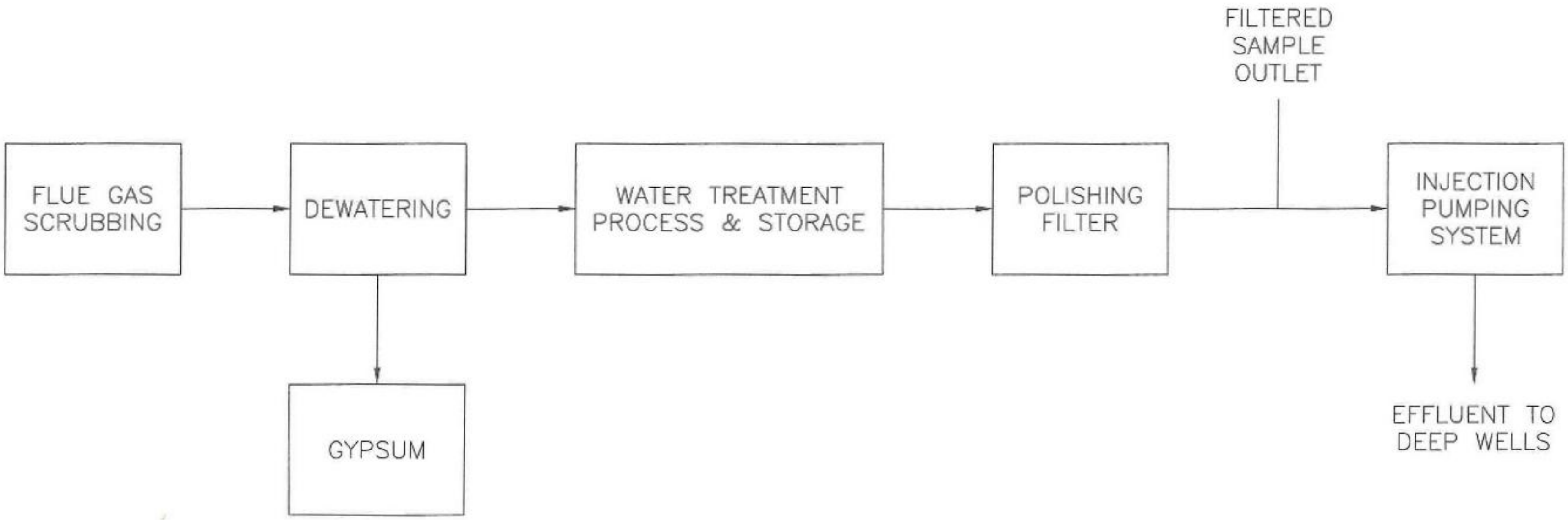
GRAVEL PACK : N/A

	TRASK*	FOLK**	MOMENT**
MEAN	0.0125	6.7338	6.8720
MEDIAN	0.0093	6.7523	6.7523
SORTING	2.1791	1.4842	1.4243
SKEWNESS	1.0434	-0.0006	0.0328
KURTOSIS	0.2476	0.8493	2.1320

* COMPUTED USING MILLIMETER VALUES
** COMPUTED USING PHI VALUES

APPENDIX B

BLOCK FLOW DIAGRAM



SUBSURFACE

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

APPENDIX B

PSI ENERGY, INC.

GIBSON GENERATING STATION

BLOCK FLOW DIAGRAM

DATE: 1/27/05	CHECKED BY: RJS	JOB NO: 60D5675
DRAWN BY: CRB	APPROVED BY: RTB	DWG. NO:

APPENDIX C

COMPACT DISC - HERITAGE ENVIRONMENTAL SERVICES, LLC QA/QC DOCUMENT

SUBSURFACE

ATTACHMENT Q

PLUG AND ABANDONMENT PLAN

SUBSURFACE

APPENDIX Q-1

Q. PLUG AND ABANDONMENT PLAN

A completed EPA Plugging and Abandonment Plan (EPA Form 7540-14) has been included as Appendix Q-1.

The estimated plugging and abandonment cost has been included on the EPA Plugging and Abandonment Plan form included as Appendix Q-1. The form was completed by Subsurface Technology, Inc., an independent firm from PSI, the owner/operator of the proposed injection wells. A breakdown of the estimated cost is as follows:

Rental Tools	$ 28,000
Cement	35,500
Logging	24,775
Rig Time	65,500
Cement Retainer	5,800
Miscellaneous	46,100
	$205,675

The following general closure procedure will be used to permanently plug and abandon the PSI injection wells. This procedure is based on placement of a balanced column of cement across approximately 2000 feet of 8.75 inch diameter openhole and into the base of the protection casing some 200 feet. Additionally, cement columns of approximately 200 feet will be placed at the base of the USDW and at the surface from 200 feet to ground level.

1. Prepare well and location for plugging. Remove surface facilities, well annulus maintenance system and injection piping.

2. Move in and rig up workover rig and associated equipment.

3. Remove wellhead assembly and install blow out preventor (BOP).

4. Release injection packer. Pull and lay down the injection packer and injection tubing.

5. Go in the hole open end with workstring to total depth and set balanced Class "H" cement plug (15.6 ppg slurry weight) across open hole section and 200 feet into protection casing. Pull up several stands and reverse out. Wait for cement to cure.

6. Tag top of cement and displace wellbore with appropriate weight mud (as determined from injection zone pressure) by circulating until equilibrium is achieved. Run bridge plug and set 20 +/- feet above the top of cement. Pressure test plug to 500 psig.

7. Mix and set 50 feet of Class "H"cement (15.6 ppg) on top of bridge plug. Wait for cement to cure.

8. Tag top of cement plug. Pressure test plug to 500 psi for 30 minutes.

9. Set a 200 foot balanced Class "A" cement plug (15.6 ppg) 100 feet above and below the base of the USDW. Wait for cement to cure.

10. Tag top of cement plug and pressure test to 500 psi for 30 minutes.

11. Set cement plug from 300 feet to the surface and top out annular area around protection and surface casing and conductor if necessary.

12. Nipple down the blowout preventor and cut off all casing three feet below ground level. Weld a 1/2 inch steel plate over the casings and inscribe with appropriate identifying information.

13. Rig down and move out workover rig and associated equipment.

14. Clean and level location to grade.

Since the proposed wells will be nonhazardous, no post-closure care will be required.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

PLUGGING AND ABANDONMENT PLAN

WELL NAME & NUMBER, FIELD NAME, LEASE NAME & NUMBER

on Generating Station
WDW 1, 2, 3
Owensville, Indiana

NAME, ADDRESS, & PHONE NUMBER OF OWNER / OPERATOR

PSI Energy
1000 East Main Street
Plainfield, Indiana 46168

STATE Indiana | **COUNTY** Gibson | **STATE PERMIT NUMBER**

Locate Well and Outline Unit on Section Plat - 640 Acres

N

SURFACE LOCATION DESCRIPTION

_NW_ 1/4 of _NE_ 1/4 of _SE_ 1/4 of ____ 1/4 of Section _5_ Township _2 S_ Range _12 W_

LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION AND DRILLING UNIT

Surface Location 0 ft. From (N/S) S Line of Quarter Section SE
And 1,104 ft. From (E/W) E Line of Quarter Section SE

TYPE OF AUTHORIZATION

- ☑ Individual Permit
- ☐ Rule
- ☐ Area Permit

Number of Wells in Area Permit ________

US EPA Permit Number ________

WELL ACTIVITY

- ☑ Class I
  - ☐ Hazardous
  - ☑ Nonhazardous
- ☐ Class II
  - ☐ Brine Disposal
  - ☐ Hydrocarbon Storage
  - ☐ Enhanced Recovery
- ☐ Class III
- ☐ Class IV

CASING/TUBING/CEMENT RECORD AFTER PLUGGING AND ABANDONMENT

Size	Wt (lb/ft) TBG/CSG	Original Amount (CSG)	CSG to be Left in Well	Hole Size	Sacks Cement Used	Type
13-3/8"	61	500	500	17-1/2"	To Surface	Standard
9-5/8"	36	3,000	3,000	12-1/4"	To Surface	Premium
7"	26	5,900	5,900	8-3/4"	To Surface	Premium

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☑ Balance Method
- ☐ Dump Bailer Method
- ☐ Two Plug Method
- ☐ Other

CEMENT TO PLUG AND ABANDON DATA	Plug # 1	Plug # 2	Plug # 3	Plug#	Plug #	Plug #	Plug #
Size of Hole or Pipe in Which Plug Will Be Placed (inches)	7"	7"					
Calculated Top of Plug (ft.)	5,600	0					
Measured Top of Plug (ft.)							
Depth to Bottom of Plug (ft.)	10,600	500					
Sacks of Cement to be Used	1,719	92					
Slurry Volume to be Used (cu. Ft.)	2,028	108					
Slurry Weight (lb./gal.)	15.6	15.6					
Type of Cement, Spacer or Other Material Used	10 ppg Mud*	10 ppg Mud					
Type of Preflush Used	* With Additive						

DESCRIPTION OF PLUGGING PROCEDURE

Pull Tubing and Packer.
Spot balanced cement plug across penhole and 200' inside protection casing.
Set CIBP on top of cement plug and inside 9-5/8" casing and place 50' of cement on top.
Displace casing with mud. Set cement plug 100' in and out of base of USDW.
Set top plug from top of USDW to surface.
Cut Casing 3' BGL, top off with cement and weld plate over casing.

ESTIMATED COST OF PLUGGING AND ABANDONMENT

Cement	$ 35,500.00	Cast Iron Bridge Plug	$ -
Logging	$ 24,775.00	Cement Retainer	$ 5,800.00
Rig or Pulling Unit	$ 65,500.00	Miscellaneous	$ 46,100.00
Rental Tools	$ 28,000.00	Total	$ 205,675.00

CERTIFICATION

I certify under the penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref.40 CFR 144.32)

NAME AND OFFICIAL TITLE	SIGNATURE	DATE SIGNED
DONALD E. FAULKNER GENERAL MANAGER GIBSON STATION	Donald E. Faulkner	2/28/05

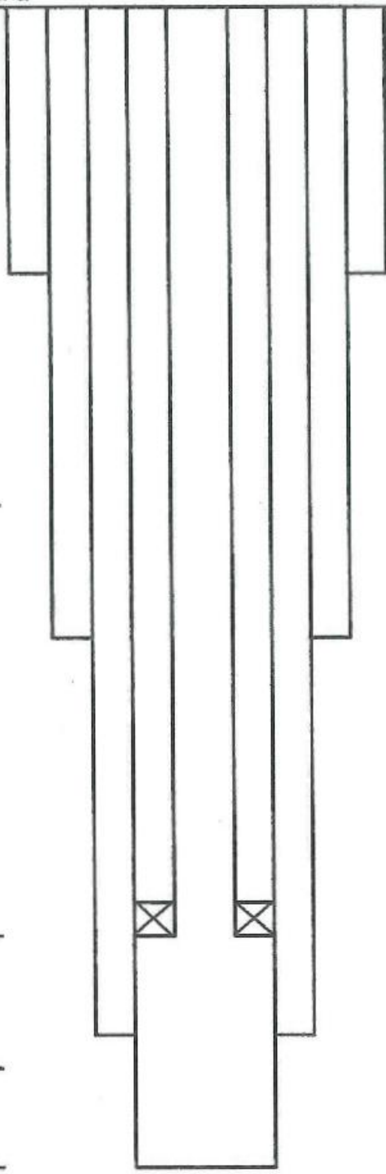
EPA Form 7520-14

ORIGINAL WELL CONSTRUCTION DURING OPERATION	PLUGGING AND ABANDONMENT CONSTRUCTION

ORIGINAL WELL CONSTRUCTION DURING OPERATION

Gibson Generating Station
WDW 1, 2, 3
'ensville, Indiana

Surface



Top of cement
Surface

Surface Casing
13-3/8" @ 500'

Top of cement
Surface

Intermediate Csg.
9-5/8" @ 3,000'

Top of Cement
Surface

Packer Depth

Perforations
Open Hole

Long String Csg.
7" @ 5,000'

Hole Size
8-3/4"

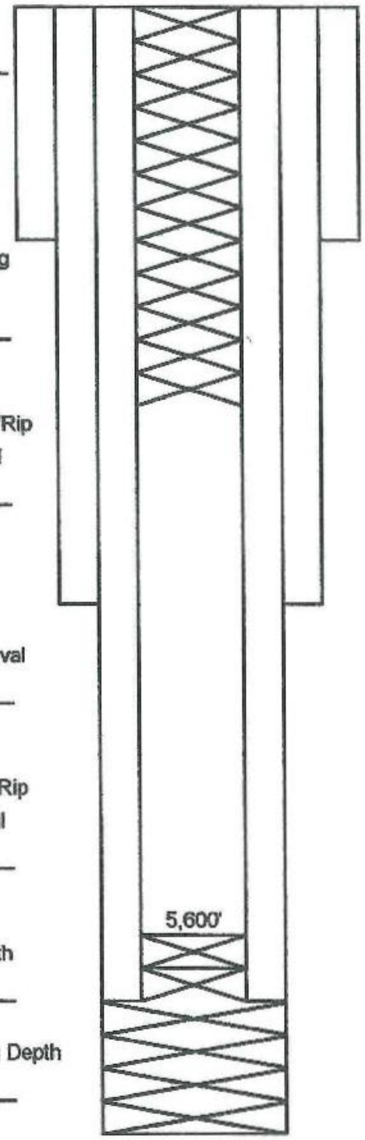
* Depth
TD - 10,600' +-

** Add Any Additional Information

* May not Apply

PLUGGING AND ABANDONMENT CONSTRUCTION

Surface



Top Plug Interval
300-0

Surface Casing

*USDW Base Plug Interval
3'-500'

USDW Base
400'

*Intermediate Cut/Rip Point Plug Interval
NA

*Intermediate Cut/Rip Depth
NA

*Intermediate Csg.
9-3/8" @ 3,000'

*Middle Plug Interval
None

*Long String Cut/Rip Point Plug Interval
NA

*Long String Csg Cut/Rip Depth
NA

Bottom Plug Depth
5,900 - TD

Long String Csg.
7" @ 5,900'

*Mechanical Plug Depth
CIBP @ 5

Depth
10,600'+-

** Add Any Additional Information

* May not Apply

LIST OF ALL OPEN AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED

Specify Open Hole/ Perforations/ Varied Casing	From	To	Formation Name	
Open Hole Interval	5,900' +-	10,600 +-	Trenton	5,090' - 5,200'
			St. Peter	5,860' - 5,880'
			Knox Group	5,880' - 8,925'
			Eau Claire	8,925' - 10,050'
			Mt. Simon	10,050' - 10,600'

ATTACHMENT R

FINANCIAL ASSURANCE

R. FINANCIAL ASSURANCE

Information regarding financial assurance will be provided under separate cover.

PSI Energy, Inc. is currently undergoing internal fiscal auditing for FY 2004 and would prefer to offer up-to-date current financial information with this application.

ATTACHMENT S

NOT APPLICABLE

SUBSURFACE

ATTACHMENT T

EXISTING EPA PERMITS

SUBSURFACE

T. EXISTING EPA PERMITS

The Gibson Generating Station maintains the following permits:

USEPA - RCRA Hazardous Waste ID IND980897730
USEPA - SPCC Plan
IDEM-OAM - Title V Operation Permit - T 051-7175-00013
IDEM - FGD Sludge Landfill - Solid Waste Permit - FP26-02
IDEM - Used Oil UST Registration (multiple)
IDNR - Water Withdrawl Registration
NRC - Radioactive Materials License - 13-15544-01
ACOE - Lake Makeup Intake - Letter of Permission - 199800820
ISDOH - Indoor and Radiologic Health, Radioactive Materials Facility Registration

ATTACHMENT U

DESCRIPTION OF BUSINESS

SUBSURFACE

U. DESCRIPTION OF BUSINESS

Applicable SIC Code: 4911 Electric Services

PSI Energy, Inc. is engaged in the generation, transmission, and/or distribution of electric energy for sale.

ff meeting

1, Room 1612

to add post closure plan to Class I permits

s and waste analysis plans can be included into permits on a case-by-case basis.

s I permits will use a consistent list of attachments (even if some of them are intentionally left blank). They can have the documents in them, be blank if not needed, or serve to point to the admin. Record where the document would stay. This last technique will be useful for large documents (like some waste analysis plans).

han did some work in organizing the class I permit structure. There might be something that he did that we could use. Steve was tasked with coming up with a list of attachments that we could standardize on.

ıl to reduce the amount of reporting required in Class I permits

ıat can we eliminate? What should we retain or start asking for. Steve had examples from the ISG application.

/erage monthly injectate temperatures can be helpful when evaluating temperature logs and should be reported.

aximum observed specific gravity should be reported

an we send them a spreadsheet similar to the one that Bill Bates developed for tracking reports from fluid analyses? Yes, but they would only be sending it to us voluntarily in that format.

1ax and min observed pH should be reported in the monthly reports.

/lake sure that the graphs will be included in the requirements. We should suggest that operators use an alternative y axis as needed.

er depth in reworked wells – when should we force companies to lower them and when ıd we allow them not to? There have been some situations where a packer was installed in /ell decades ago, the permit evaluated and ok'ed and it has been at that too shallow depth all ime. Are there other demonstrations that an operator might use to show that the fluid is not g into an unpermitted zone?

A debate took place on the value of using a temperature log to determine if a well with a packer that is too high is injecting its fluid into the zone that the well is permitted for. One of the potential options for these wells was to have them demonstrate through some well logging activity that even though the packer is too high, the fluid is going to the permitted formation.

The general consensus was that we should have them move the packer to within 100' of the top of the injection zone without exception.

No extra logs

Permit modifications could take place to add shallower formations if the well operator can't move the packer deeper.

ı additional discussion took place about whether commercial non-haz wells should be nducting "finger print" analyses. The answer was "yes."

USEPA
CHECKLIST

MICHIGAN/INDIANA
PERMIT APPLICATION CHECKLIST FOR CLASS I INJECTION WELLS

(Keyed to subsections of the Underground Injection Control permit application form)

A. AREA OF REVIEW

In Region 5, the Area of Review (AOR) is a set at a minimum fixed radius of 2 miles for non-hazardous wells; or the larger of the calculated Cone of Influence or a 2 mile radius, for hazardous wells.

For hazardous waste wells, the following information is needed to calculate the Cone of Influence:

A-2 Depth of top of proposed injection interval

A-1 Known or estimated pre-injection pressure at top of injection interval

A-3 Known or estimated specific gravity of formation fluid at top of injection interval

A-5 Depth of bottom of lowermost aquifer which qualifies as an Underground Source of Drinking Water (USDW)

A-5 Hydrostatic head (or static water level) of lowermost USDW

A-1 Expected or modeled maximum pressure buildup in the injection interval

B. MAPS OF WELLS/AREA OF REVIEW

Topographic map of AOR or area extending at least 1 mile beyond property boundaries, whichever is greater, showing the following: (Only items of public record are required.)

N/A Each major intake and discharge structures for liquid waste

N/A Each hazardous waste treatment, storage, or disposal facility

Table B-3 Number, name and location of all producing wells

Table B-1 Number, name and location of all injection wells of all classes

Tables B-1, 2 Number, name and location of all abandoned wells, plugged wells, and dry holes

Fig B-2 Known or suspected faults

Fig B-9 Location of all water wells of public record or otherwise known to the applicant, within the AOR or within a quarter mile of the facility property boundary, whichever is greater

Fig B-1, 3 Bodies of water, springs, surface and subsurface mines and quarries, residences, and roads within the AOR, or within a quarter mile of the facility property boundary, whichever is greater

The following information is also required:

B-1 List of names and addresses of all owners of record of land within a quarter mile of the facility boundary, unless waived by the Director. WAIVER REQUESTED

B-1, 2, 3 A description of the methods used to locate wells in the AOR.

C. CORRECTIVE ACTION PLAN AND WELL DATA

C-1 Corrective action plan for inadequately plugged wells in the AOR which penetrate the top of the confining zone

The following information should be submitted for all wells in the AOR which penetrate the top of the confining zone:

Appendix C-1 Well construction, date of construction and total depth

Appendix C-1 Well operator/owner

Appendix C-1 Cement records

Appendix C-1 Plugging records

Appendix C-1 Distance from proposed injection well

D. MAPS AND CROSS SECTIONS OF USDWs

Fig D-1 Stratigraphic column of site which indicates all USDWs

D-3 Data substantiating the depth of the lowermost USDW, if available

E. DOES NOT APPLY TO CLASS I WELLS

F. MAPS AND CROSS SECTIONS OF GEOLOGIC STRUCTURE OF AREA

Fig F-1 – F50 Cross sections and structure contour maps adequate to describe the regional geology of the area, including especially any faults

Drawings F-1 – F-4 Cross sections of site-specific geology, including any faulting in the AOR

F-16 Geologic description of confining zone (including lateral extent, lithologies, thicknesses, permeabilities, porosities, extent of natural or induced fractures, etc.)

F-17 Geologic description of injection zone (including depth, lateral extent, lithology, thickness, permeability, porosity, presence of natural or induced fractures, etc.)

Fig F-2 Page-sized (8 1/2" x 11") diagram showing well construction and corresponding site stratigraphy

G. DOES NOT APPLY TO CLASS I WELLS

H. OPERATING DATA

H-1 Estimated average and maximum injection rate and volume

H-1 Estimated average and maximum injection pressures

H-2 Source(s) of waste (brief description of industrial process(es) which produce the waste)

Appendix A-2 A representative waste analysis (including all major constituents and, for hazardous wastes, all hazardous constituents and characteristics)

H-2 Plans for corrosion monitoring, if the waste is corrosive

I. FORMATION TESTING PROGRAM

I-1 Procedures to verify depth of lowermost USDW, if needed

I-1 Procedures to obtain extrapolated formation pressure in porous and permeable zones within approximately 500 feet of the top of the injection zone (non-hazardous wells) or injection interval (hazardous wells)

I-2 Sampling and analysis procedures for formation fluid of 1. the first aquifer overlying confining zone (hazardous and non-hazardous waste wells), 2. the injection zone (non-hazardous waste wells) or injection interval (hazardous waste wells), and 3. the containment interval (hazardous waste wells only)

I-2 Cores and laboratory core testing for confining and injection zones (For non-hazardous waste wells, a minimum of one 30-foot core of the confining zone and one 30-foot core of the injection zone are required. For hazardous waste wells where injection of restricted wastes is proposed, one or more cores of the containment interval will also be necessary)

I-3 Determination of fracture closure pressure of injection zone (nonhazardous wells) or injection interval (hazardous wells)

I-3 Injectivity/fall-off testing of injection zone/interval, including interference testing if multiple wells are proposed

J. STIMULATION PROGRAM

J-1 Class I wells are not recommended in areas where fracture stimulation will be necessary. If it is proposed, procedures should be included in the permit application which show how the operator proposes to confine fractures to the injection formation. If acid or other type of stimulation is proposed, procedures should also be included in the permit application under this section.

K. INJECTION PROCEDURES

Fig K-1 Plant plan showing flow line of waste stream(s) to be injected

Fig K-1, K-1 Description of filters, storage tanks (including capacity), and any pretreatment processes and facilities, including location on plant plan

K-1 Description of injection pumps, including rate capacity

K-1, 2 Description of annulus pressure maintenance system

K-2 Description of alarm and shut-off system

L. CONSTRUCTION PROCEDURES

L-1 to L-6 Detailed well construction procedures

Table L-1 Estimated time table for drilling, logging and formation testing

Table L-2 Proposed open-hole and cased hole logs

L-7 Proposed mechanical integrity testing (cement bond logs, radioactive tracer log, and temperature, noise or oxygen activation log are required prior to injection of waste)

L-7 Proposed buffer fluid and volume, if any

M. CONSTRUCTION DETAILS

The following information should be included in well schematics and/or tables:

Fig M-1 Proposed construction of well, including total depth, completion type, casing sizes, types, weights, and setting depths

Table M-1, M-1 Proposed cement type and amount for all casing (All casings should be cemented to surface.)

Table M-2, M-1 Tubing and packer specifications, including size, type, and setting depths

Fig K-3 Well head construction details

Fig K-3 Location of sample tap and female coupling for independent determination of annulus pressure

N. DOES NOT APPLY TO CLASS I WELLS

O. PLANS FOR WELL FAILURES

O-1 The applicant should submit contingency plans for 1. actions that will be taken if mechanical integrity of well is lost and 2. storage or alternate treatment or disposal of waste in the case of emergency shut-in.

P. MONITORING PROGRAM

Appendix P-1 Waste Analysis Plan (see guidelines)

P-1 Description of monitoring and recording system for injection pressure, rate, and volume, and for annulus pressure

P-2 Description of sight glass level monitoring and recording, if a seal pot system of annulus pressure maintenance is proposed

N/A Groundwater monitoring plan and Quality Assurance Project Plan (In most cases, this will be necessary for new wells injecting restricted hazardous wastes. Region 5's two guidances on groundwater monitoring should be followed.)

Q. PLUGGING AND ABANDONMENT PLAN

Appendix Q-1 Signed plugging and abandonment form, showing amount and type of cement, placement method, and estimated cost. (Region 5 requires a cement plug to extend from the base of the lowermost casing to the surface.)

Q-1 Signed estimate of plugging and abandonment costs (and post-closure costs, if applicable) by an independent firm

N/A Closure plan, including plans to acquire a representative fluid sample from the first aquifer overlying the injection zone (Only necessary for wells which inject restricted hazardous wastes)

N/A Post-closure plan, which covers the requirements of 40 CFR 146.72 (Only necessary for hazardous waste wells)

R. NECESSARY RESOURCES

R-1 Signed mechanism of financial assurance sufficient to cover closure (and post-closure, if applicable) of well. (Applicants for both hazardous and non-hazardous waste wells should use 40 CFR 144, Subpart F as a guideline)

S. AQUIFER EXEMPTIONS

N/A Region 5 does not encourage applications for aquifer exemptions for Class I wells. If application is made, 40 CFR 146.4 may be used as a guideline.

T. EXISTING EPA PERMITS

T-1 Briefly describe activities which require the applicant to obtain permits under the RCRA, UIC, NPDES, or PSD programs. List all permits or construction approvals received or applied for at the facility where the well will be located, under any of the following programs:

1. Hazardous Waste Management under RCRA
2. UIC program under SDWA
3. NPDES program under CWA
4. Prevention of Significant Deterioration (PSD) perogram under the Clear Air Act
5. Nonattainment program under the Clean Air Act
6. Dredge and fill permits under section 404 of CWA
7. Other relevant environmental permits, including State permits.

U. DESCRIPTION OF BUSINESS

U-1 Briefly describe the nature of the business and list up to four SIC codes which best reflect the principal products or services provided by the facility.

PRIOR RELEASES

N/A For existing wells, list the highest injection pressure in use in this well since construction and the approximate dates of injection near that pressure

N/A List of prior releases of waste through injection wells at this facility to intervals other than that proposed in this permit application

IF THE PERMIT APPLICATION IS FOR HAZARDOUS WASTE INJECTION, THE APPLICANT MUST ALSO INCLUDE THE FOLLOWING:

N/A All applicable RCRA waste codes for listed and characteristic wastes proposed for injection in this well

N/A All applicable Land Disposal Restriction deadlines or "ban dates"

N/A Proposed schedule for submittal of exemption petition, if waste is restricted from land disposal

N/A Additional testing proposed to support the exemption petition

N/A Future plans for waste minimization and a certified statement which meets the requirements of 40 CFR 146.70(d)